Nuclear Tycoon

Designing Simulation Rhetoric for a Persuasive Game

Miska Natunen

Aalto University
School of Art and Design
Department of Media
Media Lab Helsinki

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ABSTRACT

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Abstract

Nuclear Tycoon is a persuasive game about nuclear power. The purpose of the game is to persuade the players to adopt negative attitudes towards the nuclear industry, with the method of demonstrating the problems of nuclear power and the consequences of the problems by means of simulation. The design of the game and the development of the game prototype together form the production part of the thesis.

The written part of the thesis presents theoretical studies with practical applications for game design in the fields of persuasion and game rhetoric. Especially the role of simulation and the use of simulation rhetoric in games are emphasized in the presentation. The most relevant design solutions in terms of persuasion are reviewed in the contexts of game concept design and game system design of *Nuclear Tycoon*, including analysis on the rhetorical means used in the solutions. In addition, the contents of the game prototype are described in relation to the design, and the planned further development of the prototype is presented. Finally, the feasibility of the design solutions is evaluated by comparing the solutions to recommendations derived from the theoretical studies, as well as on the basis of a small-scale play test.

Materials	
Game prototype CD-ROM	
Keywords	
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Tiivistelmä

Nuclear Tycoon on suostutteleva peli, jonka tarkoitus on muuttaa pelaajien asenteita kielteisiksi ydinvoimateollisuutta kohtaan havainnollistamalla ydinvoiman ongelmia ja niiden seurauksia simulaation keinoin. Pelin suunnittelu ja pelin prototyypin toteutus muodostavat yhdessä työn produktio-osuuden.

Työn kirjallinen osuus esittelee pelisuunnittelun kannalta käytännöllisiä tutkimuksia suostuttelun ja peliretoriikan aloilta. Erityisenä painopisteenä on simulaation mahdollistamien retoristen keinojen käyttö peleissä. Työssä käydään läpi suostuttelun kannalta olennaisimmat suunnitteluratkaisut koskien *Nuclear Tycoon* -pelin konseptin ja pelijärjestelmän suunnittelua sekä analysoidaan näissä ratkaisuissa käytetyt retoriset keinot. Lisäksi kuvataan pelin prototyypin sisältö suhteessa suunnitelmiin sekä esitellään tiedossa olevat jatkokehitystarpeet. Lopuksi suunnitteluratkaisujen toimivuus arvioidaan vertaamalla niitä tutkimuksiin pohjautuviin suosituksiin sekä pienimuotoisen pelitestauksen tuloksiin.

Aineisto	
Pelin prototyyppi CD-ROM	
Asiasanat	
suostuttelevat pelit, hyötypelit, peliretoriikka, simulaatio, pelijärjestelmä, pelisuunnittelu, suostuttelu, retoriikka	
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Table of Contents

1 Introduction

This master's thesis project got initially started with the working title "The Entertaining Environmental Simulation Game". The title has changed since, but its working version still adequately describes my main interests as a game designer: to create games that entertain, but that also utilize the traits of entertainment in the service of another cause.

One of the inspirations for my work has been the mass communication strategy called *entertainment-education*, which refers to media programs that intentionally incorporate persuasive elements in an entertainment format. The goal of these programs is to positively influence awareness, knowledge, attitudes or behaviors. For example, in some countries, television soap operas have been designed to promote social issues such as gender equality or AIDS prevention. Studies have shown that these programs have often been successful. It has even been suggested that entertainment-education can be more effective than public service advertisements or other traditional persuasive messages, because the audience is less likely to resist a message where the selling aspect is not so obvious. (Moyer-Gusé, 2008, pp. 407–409; Papa, et al., 2000)

Games are a form of entertainment that is often considered as separate from ordinary life. When players enter a game, they enter the *magic circle*, the boundaries of which separate the game from the real world. When the game ends, they step out of the circle, leaving behind anything that happened during the game. However, playing a game is always an experience for the players, like any other activity they might take part in, and these experiences always have some kind of an effect. As a result of a typical game experience, the players may feel more relaxed or more excited, they may have learned to play the game better, or they may even have gained or lost money in the case of gambling games. (Salen & Zimmerman, 2004, pp. 92–99, 481–485; Järvinen, 2008, pp. 109–111)

All the aforementioned effects are valuable in their own ways, but they are limited to the personal gain of the player. What I am after here is something that goes further, something that would aid the players to benefit not only themselves, but also others around them. Game researchers have acknowledged that games do have the potential to induce critical thinking, challenge and change existing ideologies, and bring about significant social change (Frasca, 2001; Salen & Zimmerman, 2004; Bogost, 2007). My own view is that a game can provide the player with new knowledge and experiences. These can in turn lead to increased understanding or new points of view concerning the subject at hand, and thus aid – or in other words, *persuade* – the player to make more educated decisions about the subject in real life.

Nuclear Tycoon is my experiment in designing a persuasive game. As my initial working title implies, I was interested in making a persuasive game about environmental issues, but I did not yet have a specific theme in mind. As an attempt to solve this matter, I approached Greenpeace Finland to find out whether they had any need for this kind of a game, and what would be the most suitable theme for the game. During our first discussions, it quickly became clear that their topmost priority at that moment was their nuclear campaign – thus the idea for *Nuclear Tycoon* was born.

1.1 Context of the Thesis

Whenever I speak of games in this thesis, I refer to digital games only – that is, computer games, video games, console games or any other types of games that are played on electronic devices. Thus, while many of the observations here can be applied to non-digital games as well, it should not be assumed.

I categorize *Nuclear Tycoon* as a persuasive game in order to emphasize its purpose and to distinguish it from pure entertainment games (see section 2.2 for more discussion on persuasive games). An alternative term that could have been used is *serious game*. In a broad sense, any game that is

designed for a primary purpose other than entertainment can be considered a serious game. However, in practice this term has been mostly applied to games that are designed for the needs of governments, corporations and other institutions that operate in sectors such as corporate management, health, military and science. As tools for advertising, education and training, serious games naturally function as persuasive games as well. (Bogost, 2007, pp. 54–59)

Another similar domain of game design is the design of educational games, often regarded as a branch of serious games. Digital games for educational purposes have been developed from the 1970s onwards, and studies have shown that they have potential to facilitate learning. (Kiili, 2005, pp. 12, 56–58) Much like serious games in general, educational games are mainly created to translate existing pedagogical goals to game form (Bogost, 2007, p. 57).

Nuclear Tycoon could be well regarded as a serious game, especially if Greenpeace is seen as an institution that is comparable to others mentioned above. Playing the game can also be an educative experience, although it is not designed as an educational game in the pedagogical sense. For the purposes of my work, I find the term persuasive game the most applicable, because it relates more precisely to the goal of persuasion, and less to the supposition that the design would be influenced by external institutional goals.

There are many fields of design that can affect the persuasiveness of a game, either directly by defining a persuasive rhetoric, or indirectly by affecting supporting qualities such as accessibility or usability. Examples of the former include sound design, visual design and scriptwriting, all of which can use their own rhetorical means to persuade. The latter group consists of fields such as user interface design and software design, which ensure that the gameplay is fluent and flawless, thus allowing the persuasion to work unhindered by technical or usability problems. Also marketing can be in-

cluded in this group: the game hardly gets the chance to persuade if nobody knows about it.

However, none of the above-mentioned areas of design are exclusive to games, but all of them apply to other persuasive media as well, including film, television, radio, literature and interactive multimedia. Because of this, apart from short mentions in the context of the game concept design, they are excluded from this thesis. As a game designer, I am more interested in the core characteristic of games: the system of rules that defines both the formal structure of the game and the means by which the players interact with the game (Salen & Zimmerman, 2004, pp. 82, 125).

My main focus in this thesis is the design of game rhetoric, and especially the design of simulation rhetoric in games. As I explain in chapter 2, simulation rhetoric defines how games communicate persuasively through the rule-based procedures and behaviors of the game system. Of all the types of rhetoric used in games, simulation rhetoric is the most closely connected with the rule system of the game. Because of that, I see it as the most interesting area in the study of persuasion in games. In the design chapters to follow, I discuss the solutions related to simulation rhetoric especially in the context of the game system design of *Nuclear Tycoon*. In addition, game concept design is discussed in parts where it significantly affects the possibilities for rhetoric and persuasion in the game.

Studies in player experiences can offer insights on making the experience more impressive or enjoyable, thus also creating a more fertile ground for the persuasive elements of the game. For example, transportation theory describes the experience of transportation into narrative worlds. According to the theory, a cognitive, emotional and imagery involvement in a narrative can induce change in the player's beliefs and perceptions. (Green, Brock, & Kaufman, 2004, pp. 311–315; Järvinen, 2008, p. 170)

Another popular concept is flow theory by psychologist Mihail Csikszentmihalyi. It describes optimal experience as the pleasure that occurs when someone is engaged with an activity and feels in control of his or her actions. The flow state allows people to become highly concentrated on the task at hand and lose their self-consciousness and sense of time. (Salen & Zimmerman, 2004, p. 360) This state of mind is said to be beneficial in learning and self-development, which makes it relevant in the context of persuasive games or any other games that strive for some kind of learning (Kangas, 2003).

I see these concepts as valuable perceptions on the general elements of good player experiences. As said, the quality of the experience can play an important role in persuasion. However, because of the general nature of these theories, they do not offer concrete design tools for persuasive games (Järvinen, 2008, p. 105). Thus I have chosen not to elaborate on them further.

Nuclear Tycoon presents numerous arguments on the problems of nuclear power, many of which are mentioned in later chapters. However, this thesis is not about the validity of those arguments, but only about the means by which they are communicated in the game. Moreover, as I point out in chapter 5, some of the arguments in the current prototype are based only on discussions with Greenpeace, and thus their sources are not always explicitly referenced in the text. Obviously, the validity of these arguments needs to be confirmed before the final game is published.

The above disclaimer is also related to the broader question of ethics in persuasion. In popular discourse, persuasion is sometimes confused with coercion, dishonest propaganda[1] or other similarly blatant or deceitful

[1] In the most neutral sense, the term *propaganda* only means disseminating or promoting particular ideas. Because of historical reasons, it has however lost its neutrality in popular

communication strategies. Although persuasive messages can sometimes be misleading – intentionally or not – that is not the case by default. Proper, ethically sound persuasion is always based on truthful arguments and voluntary interaction, where the persuader and the receiver are trying to reach a mutually satisfying conclusion. (Miller, 2002; Jowett & O'Donnell, 2006)

1.2 Goal of the Game Design

Based on discussions with Greenpeace, the following design objective for the game concept was set: the game should demonstrate the problems of nuclear power in a provocative and humorous way, with emphasis on the inefficiency in terms of climate change prevention[2]. Otherwise, I was given free rein to design the concept as I find best.

The generic design objective was further developed into several smaller-scale design goals[3] in three categories: 1) Entertaining the player, 2) Promoting anti-nuclear attitudes and 3) Activating players to influence decision-makers. Because of the limited scope of this thesis, I am focusing my attention on the second category only. The other categories would have been less suitable, because they are either not explicitly related to the theme of persuasion (1), or have the second category as a prerequisite (3) – that is, I am assuming that people need to possess anti-nuclear attitudes before they are motivated to pass those attitudes on to others.

In short, the specific design goal I am addressing in this thesis can be summarized as follows: the goal of the game design is to promote anti-nuclear attitudes by demonstrating the problems of nuclear power.

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discourse, and it is now commonly understood as a synonym to dishonest persuasion such as lies, manipulation and brainwashing. (Jowett & O'Donnell, 2006, pp. 2–3)

[2] The climate change aspect is not yet addressed by the current game prototype (see chapter 5).

[3] The design goals can be read in full in the game concept document in appendix A.

1.3 Goal of the Thesis

Even though the purpose of the game is to promote anti-nuclear attitudes, it is not the purpose of this thesis. Rather, the goal of the thesis is to study the general means of persuasion in games, using *Nuclear Tycoon* as a specific example case. As I have stated above, my interest is to experiment with the simulation rhetoric of the game system, and to reach for the set design goal of persuasion. Based on these conditions, I have formulated the following questions as the main research questions for this thesis:

> **What are the elements of the game system of *Nuclear Tycoon* that support the goal of persuasion? How are those elements designed in terms of simulation rhetoric?**

1.4 Contents of the Thesis

In chapter 2, I review the theories of persuasion and rhetoric that are relevant in the context of game design. I describe the field of persuasive games in general: what is actually meant by the term "persuasive game", and what kinds of rhetorical means these games can use to persuade. The role of simulation and simulation rhetoric is also discussed in the context of games.

I begin the design chapters by describing the game concept of *Nuclear Tycoon* in chapter 3. Instead of documenting all the steps of the design process, I concentrate on analyzing the outcomes of the process: what are the most significant design decisions in terms of persuasion, and how do those decisions affect persuasion.

The same point of view continues in chapter 4, where the game system design is addressed in more depth. I first explain which aspects of the nuclear industry are included in the game simulation. Next I discuss how the system is designed to support persuasion in a general level – that is, how the system

makes the complex information comprehensible to the player, and how the player is motivated to keep on playing. The final section of the chapter is the most interesting part in terms of simulation rhetoric. There I go through some central theme-related statements and analyze how they are embedded in the design of the game system, and what kind of rhetoric they use to persuade.

Chapter 5 describes the known issues in the current game prototype, as well as the development that is planned in order to address those issues. The chapter also lists the features that are mentioned in the design chapters, but not yet implemented in the current prototype version.

After that, I move on to evaluating the design and the prototype in chapter 6: how do the design solutions correspond with the ideas presented in the theory chapter, and what kind of further development would still be needed. The evaluation is supplemented by a small-scale play test. Last, I conclude the work in chapter 7 by providing a summary of the evaluation results and other findings made in previous chapters.

The work also includes three appendices: the game concept, the player's guide and the game prototype. The game concept document in appendix A was the starting point for the design of *Nuclear Tycoon*. In the context of this thesis, its main function is to provide a reference for the concept design discussion in chapter 3.

The player's guide in appendix B describes the functions of all the game's features from the player's point of view. The guide is essentially a cross between playing instructions and a full game design document. In other words, it contains more information than what would be included in actual playing instructions, but the information is not detailed enough to constitute an actual design document. The purpose of the appendix is to give a comprehensive description about the contents of the current game prototype. It

also serves readers who cannot access the prototype itself, as they can familiarize themselves with the gameplay by reading the appendix.

Appendix C is a CD-ROM that contains the game prototype. The prototype forms the production part of the thesis. It was developed in order to experiment with the design of persuasive game system elements in practice. The primary objective for the development was to implement the simulation rules in the game system so that the functioning of the simulation rhetoric could be observed. Due to this focus, many other areas are still underdeveloped, including audiovisual polish, user interface features and breadth of content. These limitations are discussed in more detail in chapter 5.

2 Persuasion and Rhetoric in Games

As it is illustrated in Figure 1, the main focus of this thesis is in the intersection of simulation rhetoric and game rhetoric – in other words, the rhetoric of simulation in games. In this chapter, I present related theories that I have found to be practical tools for either the design process or the evaluation of the design.

I start my way towards the main focus by first making some general observations on persuasion. From there on I move to the domain of games by introducing the field of persuasive games and the game rhetoric that they use to persuade. After that, I finally arrive at the sections on simulation, simulation games and simulation rhetoric, which together form the basis for the aforementioned focus of the thesis. The final section on cultural rhetoric connects the other parts of the treatise to the larger cultural context of games.

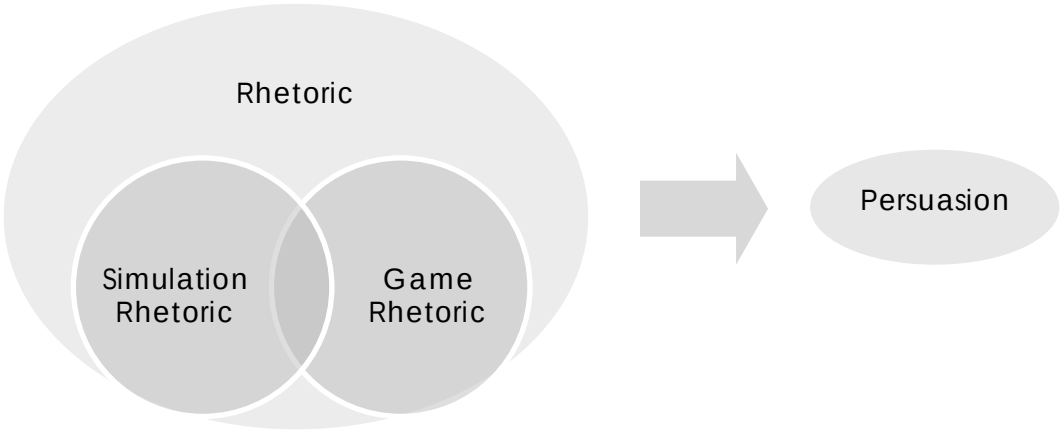

Figure 1. The theoretical viewpoint of the thesis focuses on simulation rhetoric and game rhetoric and their means of persuasion.

2.1 Persuasion

> persuade
>
> to move by argument, entreaty, or expostulation to a belief, position, or course of action[4]

The designed goal of *Nuclear Tycoon* is to persuade its players to adopt anti-nuclear beliefs and positions – that is, to begin responding negatively towards promotions of nuclear power. This goal implies that the persuasive effect would be the most desirable on players who initially support nuclear energy, or have not decided their stance towards it yet.

In terms of persuasion theory, this would be persuasion as a response-changing process, or a response-shaping process, respectively. In addition to these, being persuaded can also be a response-reinforcing process. (Miller, 2002) This means that people already opposing nuclear power can play the game and reaffirm their current views, for example by learning new information from the game – even though this is not the primary purpose of the game's agenda.

The way in which the processes of persuasion work through cognition and emotion has been extensively studied in the field of psychology. William Benoit provides a comprehensive overview on the related theories in the *Electronic Encyclopedia of Communication* (Benoit). For the purposes of my work, I find two of the theories the most applicable: *The Yale Approach* and *Elaboration Likelihood Model*. In the next subsections, I give summaries of the most relevant findings from these theories. When appropriate, I will also refer to them in later chapters, especially in chapter 6 when evaluating the persuasiveness of *Nuclear Tycoon*.

[4] Definition of *persuade* from Merriam-Webster Online Dictionary

2.1.1 The Yale Approach

The Yale Approach is based on numerous studies conducted at the Yale Communication and Attitude Change Program after World War II. Together they form a useful introduction to the basics of persuasion. According to William McGuire, the process of persuasion includes six steps:

> Presentation > Attention > Comprehension > Yielding > Retention > Behavior

In short, this model describes how the persuasive message is first presented (*Presentation*), after which the audience must notice (*Attention*) and understand (*Comprehension*) the message before it can result in attitude change (*Yielding*). In some cases, the attitude change may be only temporary, but if it lasts long enough (*Retention*), it can ultimately lead to behavior change (*Behavior*). (Benoit)

The Yale studies have discovered many different factors that can increase the persuasive effect of a message. In general, if the message is well organized and it has lots of strong arguments, preferably backed up with examples or other evidence, it is more likely to persuade. It should also present the opposing side of the issue, but at the same time make sure that the opposition is properly refuted in the presentation. Also the source of the message is relevant: if the audience perceives the source as expert and trustworthy, they are more likely to accept the message. (Ibid.)

Accordingly, if the persuasion lacks any of the aforementioned properties, it is presumably less effective. Moreover, if the audience beforehand learns that the intent of the message is to persuade, their susceptibility to persuasion is diminished. (Ibid.)

If the message tries to appeal to fear, it can increase the chance of persuasion as long as the appeal is properly formulated. First, the threat must be

serious enough and the audience must believe that they are personally under the threat. Second, the message also needs to offer such a possible solusolution to the threat that the audience feels they will be able to implement the solution. (Ibid.)

2.1.2 Elaboration Likelihood Model

Elaboration Likelihood Model (ELM) was developed by Richard Petty and John Cacioppo in 1981. It recognizes the Yale model as the central route to persuasion, where attitude change results from the thoughtful consideration of the arguments of the message. However, Petty and Cacioppo claim that there is another route that does not require the comprehension aspect: persuasion can be reached through a peripheral route where the audience decides whether to agree with the message based on other reasons besides the strength of arguments in the message. For example, the audience may decide to agree with the source of persuasion just because of its perceived expertise, credibility or attractiveness, or on the basis of the argument quantity alone. (Benoit)

Studies have shown that the central route is better in persuasion, as it leads to “greater temporal persistence, greater prediction of behavior, and greater resistance to counter persuasion” (Ibid.). Sometimes this is not possible if the receiver lacks the motivation or the ability to thoughtfully consider and understand the message, in which case the peripheral route can be taken. (Ibid.)

The ELM essentially agrees with the Yale approach when considering the factors that increase the chance of persuasion. It also adds a further definition, stating that the factors affecting the quality of argumentation are more important when the recipients are motivated and able to process the persuasive information, whereas the other factors have more impact when those motivations and abilities are low. Another interesting addition is the notion

on trustworthiness: messages from biased sources are less trusted and thus less persuasive than messages from objective sources. (Ibid.)

2.2 Persuasive Games

The most fundamental role of persuasion in games is to attract players to start playing the game, and encourage them to keep playing (Järvinen, 2008, pp. 275–277). In this sense, all games are persuasive games.

Game researcher and designer Ian Bogost has a stricter definition for the term "persuasive games". He uses it to represent games that "make arguments about the way systems work in the material world" – games that "strive to alter or affect player opinion outside of the game, not merely to cause him to continue playing". He goes as far as to claim that games can "disrupt and change fundamental attitudes and beliefs about the world, leading to potentially significant long-term social change". (Bogost, 2007, pp. ix, 47)

From the point of view of this thesis, Bogost's statements are the most interesting ones, since they accurately describe what *Nuclear Tycoon* pursues to accomplish: to affect nuclear-related beliefs by making arguments about how the nuclear industry works in the real world, potentially leading to long-term attitude change in players. Of course, also the more basic kind of persuasion needs to be successful before this – that is, the players must be persuaded to play the game in the first place.

Persuasive games have been designed for various causes. For example, *3rd World Farmer* (3rd World Farmer Team, 2008) hopes to open the players' eyes to the mechanisms that cause and sustain poverty in developing countries. *The Redistricting Game* (USC Game Innovation Lab, 2007) exposes how the system of political redistricting in the USA is subject to abuse on behalf of the state legislators. Often cited examples are also *McDonald's*

Videogame (Molleindustria, 2006) and *September 12th* (Newsgaming.com, 2003) that criticize the fast food industry and the war on terrorism, respectively (see e.g. Bogost, 2007). *Nuclear Tycoon* is not the only persuasive game that is concerned with the energy industries: *Oiligarchy* (Molleindustria, 2008a) concentrates on the problems of the oil industry (Figure 2) while games like *Energy City* (Filament Games, 2010) try to provide a more comprehensive view on the economic and environmental impacts of different energy sources.

In some aspects, persuasive games can be seen as a part of the broader concept of persuasive technology, or *captology*, as it is called by the developer of the concept, psychologist B. J. Fogg. The following definition is taken from the website of the Stanford Persuasive Technology Lab:

> "Captology is the study of computers as persuasive technologies. This includes the design, research, and analysis of interactive computing products created for the purpose of changing people's attitudes or behaviors." (Stanford Persuasive Technology Lab, 2009)

However, captology does not deploy rhetoric, but it relies mostly on psychological user responses, and as such it falls out of the bounds of this thesis.

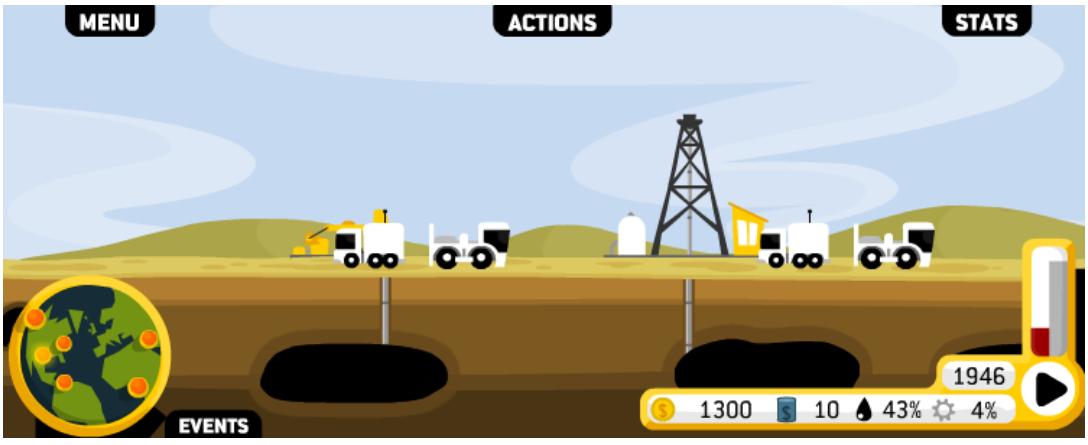

Figure 2. According to the designers of the game, *Oiligarchy* is a "playable commentary on the oil industry" (Molleindustria, 2008b).

Bogost also criticizes how captology crafts technological constraints that impose changes to beliefs and behaviors without engaging users in discourse about the reasons for those changes. Regardless of these limitations, captology seems to offer some concepts that can be used as complementary tools when designing a persuasive game. Examples of these include *reduction* and *tunneling*, which respectively refer to "[reducing] complex behavior to simple tasks" and "leading users through a predetermined set of actions, step by step". (Bogost, 2007, pp. 59–62)

2.3 Game Rhetoric

> rhetoric
>
> the art of speaking or writing effectively: as [...] the study of writing or speaking as a means of communication or persuasion[5]

Like any other expressive medium such as literature, art or film, games have their own modes of representation that are difficult or impossible to reproduce in other media. The understanding about these characteristics is essential in order to know the types and means of persuasion the medium is best suited for. The tool for achieving this understanding is rhetoric, the study of persuasive expression. (Bogost, 2007, pp. vii–46)

The purpose of rhetorical expression is to communicate values or beliefs, and to persuade others that those beliefs are correct (Salen & Zimmerman, 2004, p. 517). As the above quote from the dictionary implies, rhetoric is traditionally seen as a part of the art of using spoken or written language, originating from the practice of persuasive speech in the ancient Greece. Since then, studies in other media have adopted the term as well, and today it can be applied to all forms of cultural expression, regardless of whether they use language or any other symbolic system to convey meanings. For

[5] Definition of *rhetoric* from Merriam-Webster Online Dictionary

example, the field of visual rhetoric studies how nonverbal media, such as photography and cinema, mount arguments. (Bogost, 2007, pp. 15–21)

In the ancient Rome the philosopher and politician Cicero established the three dimensions of rhetoric: *docere*, *movere* and *delectare*. These virtues of rhetoric are still applicable to game rhetoric as well. (Haapanen, 1996; Järvinen, 2008, p. 277)

Docere means teaching on an intellectual level and proving that the presented arguments are true and acceptable. This is especially important in order to reach the comprehension step of persuasion, as described in subsection 2.1.1. According to game designer and theorist Aki Järvinen, in game design terms *docere* translates to communicating the game rules to the player in a comprehensible way. *Movere* aims for the emotional engagement of the audience, which in games is typically related to the player's experience of the goals and their resolutions in the game. Finally, *delectare* is about keeping the audience, or the player, captivated and interested throughout the experience. (Ibid.) Especially the level of challenge in the game is important in keeping the interest up – in other words, the game must not be too easy to become boring, and not too difficult to cause anxiety. Good game rhetoric combines all the three dimensions. (Järvinen, 2008, p. 277)

Nuclear Tycoon is a game with a strong thematic subject matter, and for such games the theme is the defining element for game rhetoric. As Järvinen puts it, "the subject matter of the game and the metaphor it is communicated with functions as the start and end point of any meaning-making practices outside the functional, systemic meaning stored into the rules". (Järvinen, 2008, pp. 275–276) In other words, each rule of the game should have some meaning in the context of the game theme.

To give an example, the sword fight in the adventure game *The Secret of Monkey Island* (Lucasfilm Games, 1990) is functionally a modification of a rock-paper-scissors mechanic, where the player must counter each offensive

strike with a predefined defensive move. These are represented as insults and comebacks that are shouted during the fight, communicated as lines of written dialogue (Figure 3). This kind of rhetoric portrays the fighting as a contest of wit rather than violence, adhering to the humorous pirate adventure theme of the game.

A different kind of an example is found in *Wildlife Tycoon: Venture Africa* (Pocketwatch Games, 2005). The game features a sophisticated simulation of an African ecosystem with the complete food chain from plants and herbivores to predators. The gameplay is however based on a system of currency in the form of flowers and gems, which the player gains as rewards and then spends on buying more plants and animals (Figure 3). This may be a justified solution in terms of the abstract level of the rules, but it is hard to see the connection between the currency system and the environmental theme of the game.

To design game rhetoric is to design how information on the game system is communicated to players through representation and simulation. In this context, representation "focuses on what the game system wants to represent about a certain game state, as embodied into the game elements

Figure 3. The sword fight of *The Secret of Monkey Island* has a stronger connection with the game theme than the currency system of flowers and gems in *Wildlife Tycoon: Venture Africa*.

and their configuration into game states". (Järvinen, 2008, pp. 275–292)

Narrative is a particular way of structuring representation. When understood in a narrow sense, narrative means "recounting of events by someone to somebody on a temporal axis". (Ibid.) In games, an example of this kind of narration could be an animated cutscene[6] showing the protagonist's progress between game levels, or a text passage describing a disastrous event that has happened.

2.4 Simulation

> simulation
>
> a: the imitative representation of the functioning of one system or process by means of the functioning of another
>
> b: examination of a problem often not subject to direct experimentation by means of a simulating device[7]

The Convenient Solution, a short film by Greenpeace UK, begins with images of forest fires, melting glaciers and other natural disasters, depicting the consequences of climate change. The film then moves on to explain why nuclear power is not the answer to this problem. (Greenpeace UK, 2007) These are examples of representation and narrative that have been used in anti-nuclear rhetoric.

Simulation is an alternative approach to representation and narrative. It does not only describe traits and sequences of objects and events like narrative, but also models their behavior: when and under which conditions a certain event can happen, and how likely it is. Game developer and researcher Gonzalo Frasca (2003) points out that "narrative may excel at

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[6] Cutscenes are non-interactive sequences in games that are used, for example, to advance the plot or to provide background information. (Wikipedia contributors, 2010a)

[7] Definition of *simulation* from Merriam-Webster Online Dictionary

taking snapshots at particular events but simulation provides us with a rhetorical tool for understanding the big picture."

Traditionally, simulation is used for explaining and predicting the behavior of complex systems (Ibid.). The nuclear industry, with its interconnected web of technical, political and financial issues – to name a few – is indeed a complex system, and as such it is fruitful ground for simulation-based rhetoric. The problems of the industry can also be seen as ones not subject to direct experimentation, which makes them interesting targets for examination through simulation, as suggested by the dictionary quote at the beginning of this section.

Frasca (2001, pp. 22–27) picks up three basic elements of simulation from simulation theory: the source system, the model and the simulator. The source system is the system that is being simulated. It can be either real or imaginary – the nuclear industry of the real world can be a source system, but it could also be something such as the production of tibanna gas in the fictional universe of Star Wars. The model is the simulating system as a set of rules by which input and output are generated in the simulator. Correspondingly, the simulator is the agent that generates behavior according to the rules of the model. In case of computer simulations, the computer program is the simulator.

When designing simulations, it is important to realize that a simulation cannot depict every aspect of the source system, but only a small subset of them (Salen & Zimmerman, 2004, p. 423). In simulation theory, the term *experimental frame* refers to this limitation, meaning the set of conditions under which the source system is experimented. Characteristics that are not relevant for the purpose of the simulation are excluded, left outside the frame. (Frasca, 2001, pp. 22–27) For example, a techno-utopist simulation of a nuclear plant could include models of fuel input, electricity production and such, but it might leave out the waste handling or any other safety issue involved.

2.5 Simulation Games

Like narrative is a way of structuring representation, games are a way of structuring simulation (Frasca, 2003). In some aspects, all games can be considered simulations: even an abstract game such as *Tetris* (Pajitnov, 1984) can be seen as a simulation of gravity or construction (Salen & Zimmerman, 2004, pp. 424–425). However, my main interest here is not in games *considered* as simulations, but in games *designed* as simulations.

If the term "game" is understood in the strictest sense, a simulation becomes a game only when its rule set includes explicit goal rules for the player (Järvinen, 2008, p. 59). I will, however, take a game designer's perspective here and see simulation games to include all simulations that are designed to be played like games. For example, a game like *SimCity* (Maxis, 1989) has an implicit goal of building a prosperous city and it is primarily meant to be played towards that goal, even though the players are free to ignore that – they may for example try to destroy the city instead.

In fact, most games, whether they are simulation-based or not, can be played by both ignoring and regarding the goal rules. Frasca (2003) uses the terms *paidia* and *ludus*, "play" and "game", to describe the difference: *ludus* refers to playing the game according to the rules that define a winner and a loser, while *paidia* refers to playing *with* the game regardless of such rules, as a more open-ended play within the structures of the game.

Some simulation games strive to represent the source system as accurately as possible. For example, flight simulators, such as *Microsoft Flight Simulator X* (Microsoft Game Studios, 2006), often feature realistic 3D graphics and pilot control devices, aiming to embody the sensual and material aspects of flying a real plane into the playing experience (Figure 4). However, most simulation games do not require this type of a literal approach, but instead they use metaphorical means of representation (Salen & Zimmerman, 2004, p. 427). The game *Diner Dash* (Gamelab, 2003) is still a

Figure 4. ***Microsoft Flight Simulator X*** **aims to simulate the sensual aspects of flying, whereas** ***Diner Dash*** **uses more metaphorical means of representation.**

simulation of waitressing, even though the players do not literally have their hands full of hot plates and dirty dishes.

When used as tools of rhetoric, game simulations have distinct benefits over other types of simulations. First of all, digital games are the first complex simulational media for the masses (Frasca, 2003), thus reaching a much larger audience than for example scientific simulations.

Experimentation with a simulation requires repetition in order to be fully known and interpreted. According to Frasca (2003), "in a game, going through several sessions is not only a possibility but a requirement of the medium". The conclusion is that games that enable or require multiple times of play are also good for simulation. (Ibid.) In addition, repetition is beneficial for persuasion in general as a part of the response-reinforcing process: even a successful persuasive message may lose its effect over time, if it is not regularly reaffirmed. (Miller, 2002, p. 10; see also subsection 2.1.1)

Game academics Katie Salen and Eric Zimmerman remark that even the limitation of simulations can become an asset in the context of game design. Unlike scientific simulations, the purpose of a game simulation is not essentially to be accurate or instructive, but to provide a context for meaningful

play. Because it is not possible or desirable to simulate every detail of the source system, the design is allowed to focus on the elements important for the game: which details to ignore and which to retain. (Salen & Zimmerman, 2004, pp. 425–442) Thus the game can focus on what is fun, educational or persuasive, depending on the design objectives.

Another limitation of game simulations worth noticing is that they cannot be both deep and wide at the same time – the more simulated elements there are, the less amount of detail can be included in each one. This is not only due to limited development resources, but also because, in the terms of Salen and Zimmerman, "meaningful play stems from the ability of players to make meaningful choices from a limited set of knowable options" (Ibid.). Making the choices becomes harder for the players as the number of options increases. Player expectations set by the broader context of the game are a key element in determining the proper scope of detail. (Ibid.)

2.6 Simulation Rhetoric in Games

The rhetoric of simulation persuades players to relate the simulating system to its referent, with rhetoric means that focus on the behavior of the system. (Järvinen, 2008, p. 59)

These rhetoric means are referred to as *procedural representation* by Salen and Zimmerman (2004, p. 422) as follows:

> "[Game] system generates representations from a player's interaction with the game, out of the experience and logic of play. This special class of representations, experienced as procedures, sets of behaviors, or forms of interaction, is the raw material from which simulations are constructed. We call this form of depiction *procedural representation*." (Ibid.)

Bogost (2007, pp. ix–3) uses the term *procedural rhetoric* in a similar manner, tying it more tightly with the context of persuasion. He defines

Figure 5. *CarbonECO* uses simulation rhetoric to persuade, whereas *Climate game* relies mostly on visual rhetoric.

procedural rhetoric as "the art of persuasion through rule-based representations and interactions rather than the spoken word, writing, images, or moving pictures", or as a "practice of using processes persuasively". According to him, procedural rhetoric is the very source of the persuasive power of games. (Ibid.)

For all the aforementioned authors, behaviors and processes are the key elements for simulation rhetoric. They refer to functions performed by both the game system and the player, such as the behavior of the game program's artificial intelligence, the core mechanic of the game, or the actions of the players as they follow the rules of the game (Salen & Zimmerman, 2004, p. 427).

The value of simulation rhetoric can be discerned by comparing a game that utilizes it to a game that does not. The example games shown in Figure 5 are *CarbonECO* (Plaisted, 2008) and *Climate game* (Bombsquad, 2006). Both of them are persuasive browser games that are supposed to raise environmental awareness. In *CarbonECO*, the player helps a family to reduce their carbon footprint by controlling the consumption of electricity at their home and purchasing new energy-efficient appliances. *Climate game* is a platform game where the player character stops global warming by destroying cars and other polluting vehicles and collecting CO_2 molecules from the air. The

essential difference is that the rhetoric of *CarbonECO* relates the player actions directly to the relevant behaviors of the source system, whereas the destroying and collecting activities of *Climate game* have little to do with any actual solutions to climate change.

As with all kinds of rhetorical expression, the purpose of simulation rhetoric is to communicate an ideology. According to Frasca (2003), this communication can be achieved through four different levels of simulation. The first of them is the level of representation and narrative, which I have described in the previous chapters.

The second one is the level of *paidia*: the manipulation rules defining which actions are possible for the player in the simulation. The goal rules, or *ludus* rules, define the third level of ideology: which actions are mandatory for the player in order to win the game, and which conditions can cause the loss of the game. (Ibid.) To use traffic safety in driving games as an example, consider the ideological difference between the games *Grand Theft Auto III* (DMA Design, 2001) and *Carmageddon* (Stainless Games, 1997): in the former, it is possible, but not necessary, to run over pedestrians, whereas in the latter the race can be won by killing all pedestrians in the area.

Frasca's fourth ideological level is that of the meta-rules, which are the rules that state how the manipulation rules and the goal rules can be changed. This level, however, applies only to games that allow themselves to be modified through mods[8] or by directly editing the source code. (Frasca, 2003)

When designing the rhetoric of simulation, it should be taken into account that simulation is subject to different interpretations on behalf of the players. The player's knowledge and experience of both the model and the

[8] Mods are modifications to an existing game, made both by game developers and the general public. Mods can add new content or features, or they can turn the game into an entirely new game. (Wikipedia contributors, 2010b)

source system affect the interpretation. Simulation authors may try to use different techniques, such as training levels or written manuals, to guide players towards the intended interpretation. (Frasca, 2001, pp. 28–46)

2.7 Cultural Rhetoric

So far, I have been discussing game rhetoric on an individual level; that is, how a game can persuade an individual player to adopt a certain value or belief, as intended by the game designer. This will be my focus on later chapters as well, but I will now briefly step out of it to connect my arguments to the larger cultural context of games.

To continue with the above example of driving games, the *Grand Theft Auto* series and *Carmageddon* have both caused controversy because of their violent content. *Carmageddon* was censored or completely banned in several countries. *Grand Theft Auto III* was even blamed to be a cause for murders committed by teenagers who had played the game. (Laaksonen, 1997; Yi, 2003) On the other hand, there are driving games like *Crazy Taxi* (Hitmaker, 1999), where it is impossible to run over pedestrians – they always manage to jump aside at the last moment. This more unrealistic simulation of pedestrians saves the game from the violence debate, but at the same time the game could be seen as encouragement to reckless driving because it downplays the actual consequences of traffic accidents.

Media violence is a common example of public discourse which games are involved in. In games that are designed purely for entertainment, like the aforementioned driving games, this involvement may not always be a conscious choice on behalf of the designers. However, games can also play active roles in these discourses. Both Bogost (2007, pp. 75–79) and Järvinen (2008, pp. 286–287) use *America's Army* (2002) as an example: a first-person shooter game produced by the U.S. Army. One of the most obvious purposes of the game is to promote the one-sided perspective of United

States in the political discourse concerning global conflicts. The manner in which *Nuclear Tycoon* aims to play its part in the discourse on energy politics is similar to this – regardless of the self-evident differences in the actual ideologies behind these two games.

Game designs communicate discourses by means of their system behavior, and the players interpret this communication through their own cultural contexts. This is the starting point for the cultural rhetoric of games. (Järvinen, 2008, p. 287) From this viewpoint, games are ideological systems where beliefs and values present within culture are always a part of a game, intended or not. Game designers can take this into account or even actively incorporate it into the design. (Salen & Zimmerman, 2004, pp. 516–528)

3 Game Concept Design of *Nuclear Tycoon*

In this chapter, I give an overview of the game concept, concentrating on the parts of the concept that are the most significant in terms of persuasion. The full game concept document is included in appendix A.

The concept was designed in co-operation with Greenpeace Finland. Thus the design solutions that I present here – and the motives for those solutions – are formed from a combination of my own ideas and the objectives of Greenpeace.

As it is written in the concept, *Nuclear Tycoon* is a game about building and managing nuclear power plants. The player takes the omnipotent role of the leader of a nuclear power corporation alliance, with the main goal of reducing global CO_2 emissions as much as possible. This is of course done by building more nuclear reactors. While doing that, the player also needs to secure the sufficiency of money, uranium and other resources, and avoid problems such as accidents, pollution and angry citizens.

As one might figure from the above description, the game seems to pose as pro-nuclear propaganda at first, but as the play progresses, the satirical style of the game is intended to turn this message to the opposite direction. The anti-nuclear rhetoric is embedded in ironic narrative elements and, above all, in the behaviors and processes of the game system – that is, as simulation rhetoric. According to persuasion research, this type of a two-sided handling of the issue, where the side opposing the intended message is presented but simultaneously refuted, can lead to more effective persuasion (Benoit).

Figure 6. The educational aspect of *NukeSweeper* is the map that is based on real locations of nuclear weapons. Otherwise it functions exactly like any other *MineSweeper* variant.

The simulation of the nuclear industry is a novel idea in games: no other similar games are known to exist. There are other games that are related to nuclear energy though: for example, *Nuclear War* (New World Computing, 1989) is a game where players destroy each other using nuclear weapons, and *Nuclear Power Plant Simulator* (Noles, 2007) lets the player control a single nuclear reactor. Greenpeace International (2010) has published several casual on-line games on their website, some of which handle nuclear power, including *Nuclear Solitaire*, *Nuclear Tetris* and *NukeSweeper* (Figure 6). As the names already suggest, these games are just variants of existing games that are equipped with a new visual rhetoric and some occasional pieces of narrative rhetoric in the form of text – none of the games utilizes simulation rhetoric.

In terms of rhetoric, *Nuclear Tycoon* is more akin to the persuasive games listed in section 2.2. The game has much in common especially with the oil industry game *Oiligarchy* (Molleindustria, 2008a), which possesses a similar satirical approach and a simulation that encompasses also the political and social dimensions of the industry at hand.

In the sections to follow, I address two ways in which concept-level design decisions can affect persuasion: 1) by attracting the desired target group to play the game before the actual game system has the chance to persuade, and 2) by directly affecting the possibilities for persuasive design in the game system. These two ways correspond to the *Attention* and *Presentation* steps in McGuire's theory of the persuasion process, respectively (see subsection 2.1.1). Sections 3.1 – 3.3 on the target group, the game format and the interface metaphor concentrate on the first category, whereas the remaining sections 3.4 – 3.6 on the game genre, the narrative rhetoric and the player's role are more related to the second category.

3.1 Adults as the Target Group

Nuclear Tycoon is primarily targeted at adult players. This was decided on the basis of the assumption that, compared to children, adults have better abilities to comprehend all the issues related to nuclear power, and they also have possibilities to influence these issues in the real world. Although games are still considered as children's activities by some, most players of digital and casual games today are adults (Karvinen & Mäyrä, 2009; Dobson, 2006)[9].

As an extra definition to the target group, the game is especially aimed at players who do not initially possess anti-nuclear attitudes. This is the group where the game can potentially have the most effect, in the form of increased knowledge and attitude change. In terms of persuasion theory, the game aims for persuasion as a response-changing or response-shaping process, as mentioned in section 2.1.

[9] The game is designed to support localization so that different versions of the game can be targeted to different countries. Here I am primarily discussing the version that is targeted at Finnish audience. As references in regarding player statistics, I am using both Finnish and worldwide studies. As such, not all of them are directly applicable to the discussed target group, but for the purposes of this thesis, I have found them accurate enough.

3.2 Casual Online Game as the Format

In order to make the game as accessible as possible for the target group, *Nuclear Tycoon* is developed as a casual online game – a strategy that many acclaimed persuasive games have adopted before, examples including *McDonald's Videogame* (2006) and *Oiligarchy* (2008a) by Molleindustria (see e.g. Bogost, 2007, pp. 29–31 and Dugan, 2008). The term "casual" implies that the player does not have to be an active game hobbyist, but the game is intuitive to play even for an inexperienced user (Boyes, 2008). Rollings and Adams comprehensively define the needs of casual gamers as follows:

> "[C]asual gamers play for the sheer enjoyment of playing the game. If the game stops being enjoyable or becomes frustrating, the casual gamer will stop playing [...] A casual gamer is simply not willing to spend hours learning complex controls [...] To design a game for casual gamers, you have to challenge their minds at least as much as their motor skills." (Rollings & Adams, 2003, pp. 41–42)

As an online game, *Nuclear Tycoon* runs in a web browser without requiring any special installations, other than the near-ubiquitous Flash plug-in. The Flash format also makes it possible to publish the game on casual game portal sites on the web. This makes the game more available for players who are not initially interested in the theme of the game, and therefore are not likely to be browsing the Greenpeace websites and discovering the game there.

Labeling the game as "casual" instead of "educational" or "serious" makes it also more attractive to the visitors of the game portals, who more probably want to be entertained rather than educated or persuaded. This approach is similar to the mass communication strategy of entertainment-education, where persuasive elements are embedded in popular media programs (see chapter 1).

3.3 Card Game as the Interface Metaphor

Nuclear Tycoon uses a card game metaphor as the user interface: all the player's possible actions are represented as cards, which are played on the map that functions as the game board. Similar solutions have been seen in other games as well. For example, one of the main inspirations for the game mechanics of *Nuclear Tycoon* was *Armageddon Empires* (Cryptic Comet, 2007), a computer strategy game that combines the metaphors of a collectible card game and a board game. *Climate Challenge* (Red Redemption, 2007), published on the BBC website, is an example of a persuasive game, where the player tackles climate change by using "policy cards" as the main interface element (Figure 7).

This choice of metaphor is yet another way of making the threshold of getting into the game as low as possible. The game mechanics of playing cards are universally familiar and thus for many it is easy to learn to play their digital versions as well. *Windows Solitaire* is still one of the most-played

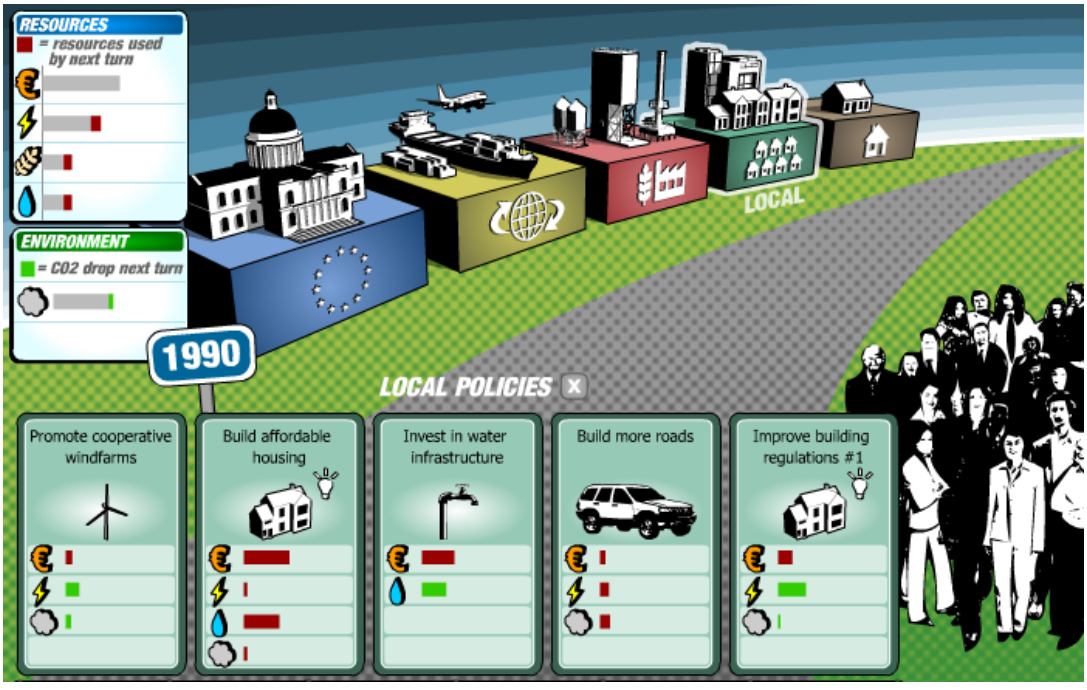

Figure 7. Climate Challenge is another persuasive game that uses cards as interface elements.

computer games – one of the most-used Windows programs in fact – and card games in general are rated high in popularity among casual games. Interfaces based on the card game metaphor have been suggested as fun and easy alternatives for non-game applications as well. (Fetter & Gross, 2008; Levin, 2008; Dobson, 2006)

The use of cards also serves to reduce the perceived complexity of the game system (see section 4.2 for more discussion on complexity). New features can be added to the game as new cards, without complicating the gameplay. This would be more challenging in interfaces based on icons or menus, such as in *Oiligarchy*, where each new feature would require the player to learn the meaning of a new icon or a new menu item.

3.4 Construction and Management Simulations as the Game Genre

Despite its interface metaphor, *Nuclear Tycoon* is not a card game as such: from the point of view of the game simulation, the action cards are not considered as physical card objects but rather as the player actions that they represent. A better genre nomination for the game is construction and management simulations, or CMS for short, described by Andrew Rollings and Ernest Adams (2003) as follows:

> "Construction and management simulations are games about processes. The player's goal is [...] to build something within the context of an ongoing process. The better the player understands and controls the process, the more success he will have at building." (Ibid., p. 417)

This is a fitting description for *Nuclear Tycoon*, since understanding the processes of the nuclear industry is one of the keys to the persuasive rhetoric of the game. The slow-paced nature of CMS games further supports this view: the gameplay encourages thinking and planning, which undoubtedly contributes to the understanding better than fast reflexes required in action

games. This assumption is in line with the ELM approach to persuasion, where thinking and understanding are the key components in achieving the better central route to persuasion (see subsection 2.1.2).

Framing the game as a simulation game ensures that the benefits and rhetorical tools offered by the simulation approach, as described in sections 2.4 – 2.6, can be used consistently in the game design. I will return to this in more detail in the context of the game system design in chapter 4.

I would assume that the simulation of the nuclear industry is not commonly thought of as a casual task, which makes it admittedly challenging to shape that into a casual game. Simulations of complex systems have however been seen in casual games before: for example, the games *Build-a-lot* (Big Fish Games, 2007), *Cargo Bridge* (Limex Games, 2009) and the aforementioned *Oiligarchy* respectively simulate real estate business, bridge building physics and the oil industry. Adhering to the concepts introduced in sections 2.4 and 2.5, the complexity of the source system is not overwhelming to the players of these games because the framing, depth and breadth of the game simulation are adjusted to suit the expectations of the casual player.

3.5 Satirical Humor as the Style for Narrative Rhetoric

Although my main focus in this thesis is in the rules of the game system, the first ideological level of simulation – that of representation and narrative (see section 2.6) – also deserves a mention, as it complements the ideological levels of the rules by aiding the player in their interpretation.

The most prominent narrative elements of *Nuclear Tycoon* are the card description texts. The satirical effect is pursued by the ironic and sarcastic tones of the descriptions. For example, by playing the uranium trade card titled “Krasnokamensk” the player gets to buy uranium from the Krasnokamensk mine in Russia. The card description says:

> "We promise that all environmental issues concerning our mines are handled in an exemplary way!"

The irony is that the mine is indeed an example of environmental concern, but in the negative sense: it is notorious for the large amounts of radiation and pollution it has emitted into the surroundings (see e.g. Belton, 2006).

In many cases the source of irony is also in the contradiction between the narrative rhetoric and the simulation rhetoric of the card. An example of this is the cards that trade radioactive materials to Iran and North Korea. The descriptions on these cards assure that the materials are for peaceful purposes only, but still their most substantial effect on the simulation is the increase in the proliferation risk variable.

The purpose of satire in *Nuclear Tycoon* is to clarify the contradiction between the seemingly pro-nuclear player goals and the actual anti-nuclear design goals. The main part of the persuasive message is embedded in the simulation, but the player needs to play the game for some time – or possibly multiple times, as noted in section 2.5 – before the message has unfolded sufficiently. The satirical narrative elements prevent misinterpretation by hinting at the underlying ideology right from the beginning.

Of course, the satire itself may face the danger of being misinterpreted, leading to the loss of its persuasive effect. One way to counter this is to accompany the satirical persuasion with another, more straightforward form of persuasion. (Gruner, 1992) *Nuclear Tycoon* applies this strategy by basing all of the game content on factual information. For example, the associate characters are based on real public figures, the contractor cards are named after existing nuclear plant vendors, and the uranium trade cards have actual uranium mine locations as their sources. The world event cards describe actual historical incidents, and it is also possible to add new current world events to the game right after they occur, thanks to the updateable

online format. Even many of the more speculative disaster cards have their origins in documented accidents (see e.g. BBC, 2006). To further add to the credibility of the data, explanations on the factuality of the cards and their information sources are available for the player in separate in-game help screens[10]. As a means of persuasion, the factual content elements function as examples that back up the game's arguments and thus make them more effective in persuasion (see subsection 2.1.1).

3.6 Player's Role as the "Evil" Tycoon

The background story of *Nuclear Tycoon* puts the player in the shoes of the "evil" tycoon and encourages building more nuclear reactors, which is the very thing that the game is supposed to oppose. A similar point of view has been adapted in many other satirical works as well (Encyclopaedia Britannica, 2010).

Alternatively, *Nuclear Tycoon* could also have chosen to use persuasion in a more direct way, for example by having the player take the role of a Greenpeace activist, who has to use different actions to convince politicians and the public about the dangers of nuclear power. This approach was not chosen because it would have assumed that the player had already adopted the reasons behind those actions. For a game that tries to encourage critical thinking, it seems more fruitful to concentrate on the reasons themselves, that is, on understanding how the processes of the nuclear industry work. A similar stance on the design of persuasion can also be perceived in Bogost's criticism about captology (see section 2.2).

The designers of *Oiligarchy* argue that pushing the player to the evil side does not undermine the game's message, but instead clarifies the understanding because the industry is represented from a position that lies inside

[10] The help screens are not yet implemented in the current game prototype (see chapter 5).

the system. In addition, they confirm the weakness of the opposite approach by stating that “games rewarding (virtual) social change do not produce activists for the same reasons games rewarding (virtual) violence do not produce violent players”. (Molleindustria, 2008b)

4 Game System Design of *Nuclear Tycoon*

As the previous chapter concentrated on the most significant parts of the game concept in terms of persuasion, this chapter in turn examines the game system design from the same point of view.

By game system design I refer to the design of the game rules, including the rules by which the player interacts with the system. This also includes the rules of the simulation, which are the building blocks for the game's simulation rhetoric and thus receive the most attention in this chapter.

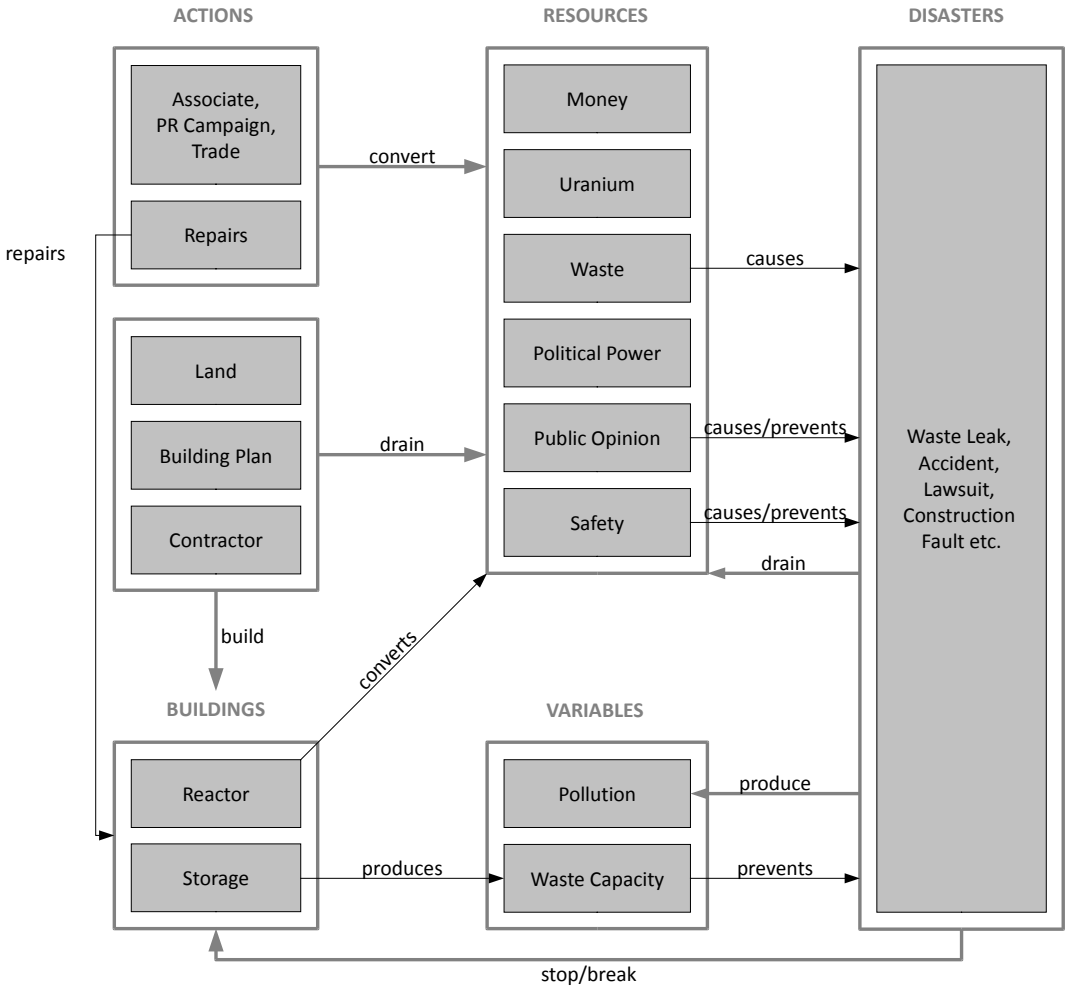

Figure 8. The main elements of simulation in Nuclear Tycoon.

4.1 Framing of Simulation

To get started with the simulation design, the aspects of the source system that will be included in the simulating model need to be selected first (see section 2.4). The above diagram (Figure 8) is a simplified visualization of the model used in *Nuclear Tycoon*, including the main objects of the simulation and the most relevant relationships between them.

The main elements of simulation in CMS games in general are *resources* that form the building blocks for the game's internal economy, *sources* that produce resources, *drains* that consume resources, and *converters* that turn one or more types of resources into another (Rollings & Adams, 2003, pp. 418–420). In *Nuclear Tycoon*, the player manages six different resources: money, uranium, waste, political power, public opinion and safety. The tools for this management are the action cards, which essentially function as one-shot drains and converters. For example, uranium trade cards convert money into uranium. Land, building plan and contractor cards initially only drain resources, but they are needed to build reactors, which in turn work as converters when ready, continuously turning uranium into money and waste.

Another important task in simulation design is to consider the breadth and depth of the simulated elements (see section 2.5). The starting point for the rhetoric of *Nuclear Tycoon* is to get the big picture on how the nuclear industry operates, which calls for a wide simulation. In other words, there are relatively many simulated elements. This also helps to increase the quantity of persuasive arguments, potentially leading to more effective persuasion (see subsection 2.1.1). Consequently, the simulation of most of the individual elements is not very deep: for example, it is modeled that reactors need uranium in order to operate, but what is left out is the enrichment process that in reality is needed before the uranium can be used to fuel the reactors.

The elements that are central to the goal of demonstrating the problems of nuclear power are simulated more deeply. Examples of this include the classification of the different risk types in the context of safety; and the tangibility of the waste resource, or how the waste can be transported from reactors to storage buildings and abroad. These examples are discussed in more detail in section 4.4.

In the following subsections, I present the main features of the game simulation: how the player interacts with the game by using the action cards; how reactors and other buildings are constructed; what is the role of the human resources of political power and public opinion; and how the system of risks and disasters represents the problems of the industry. Each description also discusses the main persuasive messages that the procedural rhetoric of the feature is supposed to communicate.

4.1.1 Player Actions

The action cards represent action proposals that are handed to the player by the board of directors (Figure 9). It might seem that they are picked randomly from a deck of cards, but this is actually not the case. The deck logic is programmed so that it is partly random, but it also avoids drawing card types that are already in the player's hand. In addition, the drawing logic avoids cards that are unplayable at the current moment because of reasons such as the lack of a certain resource. As a result, the most of the time the

Figure 9. The action cards represent action proposals from the board of directors.

player's hand should include many different card types and many of the cards should also be playable.

The favorable logic simulates the directors' sincere effort to give suitable proposals for each situation. The partial randomness simulates the fact that the most suitable proposals are not always available. For example, a certain contractor might be fully occupied in construction projects for other corporations, and thus does not appear in the player's hand. As a whole, the system of cards complements the game's message by representing the operation of the nuclear industry as a kind of a "gamble with the future".

4.1.2 Buildings

In order to build a nuclear reactor or any other building in the game, the player has to play three different cards before the construction starts: a land card, a building plan card and a contractor card. This sequence and the random availability of the cards together simulate the lengthy process of nuclear construction in real life, where time is consumed by several different license applications, investor acquisition, reactor plan modifications and of course the construction itself. Furthermore, the process can be delayed even more if a construction fault disaster occurs – an element of the simulation inspired by the infamously delayed construction of the Olkiluoto-3 reactor in Finland.

4.1.3 Political Power and Public Opinion

Nuclear Tycoon is not just about the mechanics of building nuclear plants, but also the more human resources of political power and public opinion play an important role in the simulation.

The political power resource represents the percentage of support for nuclear power in the government: if it is 50% or less, the player cannot play any

reactor cards because the government will not approve any more nuclear construction. More political power can be gained by playing associate cards that turn politicians, scientists and other influential people to the player's side.

The public opinion is primarily represented as a nuisance for the nuclear tycoon, because its main role is to cause disasters such as lawsuits, demonstrations and other bad media publicity. As a slight criticism towards the passivity of people that is sometimes observed in the matters of nuclear politics, the general public is presented as somewhat gullible: public opinion can always be improved easily by playing some of the PR campaign cards, no matter how ridiculous they are. Also, the simulation includes the element of oblivion: if the player manages to avoid new disasters for a while, the people forget the past incidents and the public opinion starts to slowly improve on its own.

4.1.4 Risks and Disasters

The game's system of risks and disasters simulates the problems of the nuclear industry and their consequences – a notable side of the industry in terms of the game design goals. In a rhetorical sense the disasters provide evidence for the game's arguments by reminding the player of accidents that nuclear power has caused in the past, and can possibly cause in the future. The threat of disasters in the game can also be seen as a fear appeal, which can potentially increase the effect of persuasion (see subsection 2.1.1).

In short, there are three "cause resources" for disasters: a large amount of waste, bad public opinion and low safety. Accordingly, the probability of disasters can be reduced by increasing waste capacity, improving public opinion and repairing the safety hazards.

The guideline in the design of the simulation is that all disasters should have a discernable cause in the player's actions. This is implemented in three types of rules in the game logic. The first and the most obvious relationship is that the type of the disaster is determined by the type of the risk that the player has taken; for example, neglecting reactor safety causes accidents in reactors but not anywhere else. The second rule is about the severity of the risk: the most serious disasters are not possible until the value of the cause resource passes a certain threshold. Third, some of the disasters are only triggered by a specific player action. For example, the study on the increased risk of cancer cannot appear until the player has caused some radioactive pollution.

The effects of disasters function as punishments for the player: they drain resources and may stop buildings from operating or break them down. The resource drain aspect can also affect the cause resources, possibly leading to subsequent and potentially more serious disasters.

4.2 Handling the Complexity of Information

When designing a game out of a complex system like the nuclear industry, special care is needed in order to not make the game appear as too complex to the player. After all, the proper organization of a message is a prerequisite for its understanding, which in turn is vital in successful persuasion. This is especially important when aiming for the central route of persuasion that is achieved only through the thoughtful consideration of the message (see section 2.1.).

In this section, I present some of the measures that have been taken to make the game information as comprehensible as possible. These measures can be seen as a part of designing the intellectual or *docere* dimension of game rhetoric: communicating the rules of the game in an understandable way (see section 2.3).

In this context, I use the concept of information to refer to knowledge or content that is manipulated, acquired or revealed during game play (Salen & Zimmerman, 2004, p. 211). This concerns all types of information in the game, including the rules and game mechanics that define how the game is played, and the persuasive thematic content that provides knowledge on the problems of nuclear power.

The first step in reducing complexity is the framing of the simulation, which was discussed in the previous section. The other means that I present below concern the structure of the game and its user interface. The interface design in general plays an important role in hiding the perceived complexity of a game (Rollings & Adams, 2003, pp. 184–192), but as a whole it falls out of the scope of this thesis. Thus I will only address the parts of the user interface where it directly affects the understanding about the game's persuasive goals.

Waste and safety are the key resources through which the problems of nuclear power are simulated in *Nuclear Tycoon*. They are modeled in a rather complex, building specific manner, as will be described in section 4.4. In addition, the total amounts of waste and safety are displayed on the player's resource counters that are visible at all times. They alleviate the complexity by providing a summary of all the separate cases of waste storage or safety hazard in a single numerical figure. This way they function as sorts of analysis tools, which in CMS games in general are essential to give the player an understanding about the simulation (Rollings & Adams, 2003, pp. 432–433).

A lot of the game's thematic content is presented as text, which could potentially become overwhelming for the player who would probably rather play than read. To overcome this problem, Rollings and Adams suggest the compartmentalizing of information (Ibid., p. 187). In *Nuclear Tycoon*, the solution is to distribute information in small portions in the form of card description texts and advisor speech bubbles, keeping the individual text

Figure 10. Information is compartmentalized in card descriptions and speech bubbles.

passages as short as possible (Figure 10). This way, the text is always presented in the context where it is relevant, thus also giving the motivation for the player to digest it.

The gameplay of *Nuclear Tycoon* is divided into levels[11], which are further paced by missions, which the player must complete in order to reach the next level. This division allows a narrative structure where each level concentrates on only one or two nuclear-related issues at a time, instead of throwing the whole network of problems at the player at once. The levels can also be arranged in such a manner that the first level presents only a small subset of the available action cards to the player, after which the complexity is gradually increased by adding new cards to the game on each consecutive level.

The advisor character is a common tool in CMS games. Its purpose is to warn the players of emergencies and inform them about the general state of the game. (Rollings & Adams, 2003, p. 436) In *Nuclear Tycoon,* the advisor is especially used as a tutor at the beginning of the game. The main view of the game contains a lot of information, which may seem daunting for a new player, but the advisor cushions the impact by guiding the player through the most important actions step by step. The advisor can also voice his opinions concerning the theme of the game, which can be used to focus the player's attention on the specific nuclear issues that are handled on the current level.

[11] The level structure is not yet implemented in the current game prototype (see chapter 5).

The mission structure and the use of the advisor as the tutor are ideas that are supported by the *reduction* and *tunneling* concepts of captology. In other words, the mission structure reduces complex behavior to simple tasks, and the advisor leads the player through a predetermined set of actions (see section 2.2).

4.3 Keeping the Player Motivated

As the previous section discussed *docere*, the intellectual dimension of rhetoric, this section moves on to *movere*: how to get the players emotionally engaged with the game.

The emotion that is typically sought for in games is pleasure. The key components that shape the experience of pleasure are the goals of the game, including both the main goal and the short-term goals that need to be reached before that. The enjoyment arises not only from the achievement of the goals, but also the effort to reach them is in itself pleasurable. (Salen & Zimmerman, 2004, pp. 360–361; see also section 2.3)

CMS games are a special case in the sense that many of them do not have an explicit main goal at all, but the player is just expected to play and build as effectively as possible. The player gets to be playful and creative and experiment with the game world, and the pleasure results from that alone. (Rollings & Adams, 2003, pp. 417–430)

As a CMS, *Nuclear Tycoon* satisfies the player by providing the possibilities for building and experimenting, but it also sets goals for the player. The main goal to build as many nuclear reactors as possible is somewhat ambiguous, but the short-term goals, implemented as missions, have more precise conditions. The missions are completed by reaching targets such as building a certain amount of new reactors, or getting some resource amounts above a certain level.

In order for the goals to be motivating, players need to be able to monitor their progress towards the goals, and preferably be rewarded somehow when they reach the goals (Järvinen, 2008). In *Nuclear Tycoon*, the main monitoring tools are always visible in the main game view: the resource counters show the current amounts of resources, the map shows the state of the player's reactors, and the separate mission pane shows the current missions as well as the completed ones. In addition, after every five years, a progress report is displayed, containing summaries such as the total amount of completed reactors and the total amount of profits gained.

The reward for reaching the goals is the player's advancement in the game. Completing reactors brings the player closer to the main goal while also increasing the player's yearly profit and thus aiding in the construction of the next reactor. The reward for completing all missions is the entry to the next level of the game.

4.4 Embedded Statements

In addition to the feature-specific persuasive messages discussed above (in subsections 4.1.1 – 4.1.4), there are also some overarching statements in the game, each of which is communicated through several different instances of game rhetoric. These statements deal particularly with the problems of the nuclear industry, and as such they are central to the design goals of the game. In the following subsections, each subsection heading contains one statement. The statement is then discussed in the content of the subsection, along with descriptions of the different instances of game rhetoric through which the statement is embedded in the game.

4.4.1 "Money is the main motivation"

Like many other CMS games, *Nuclear Tycoon* follows the capitalist worldview by having money as the most important resource (Rollings &

Adams, 2003, p. 418). Every single action card in the game either increases or decreases the player's money counter. Even the nuclear reactors function primarily as producers of money. The electricity production and sales factors have been deliberately left out from the equation in order to crystallize the rhetorical expression.

Political power is another essential resource in *Nuclear Tycoon*. As described in subsection 4.1.3, political power is gained by using the associate cards. Again, most of these cards cost money to play. It is up to the players to decide whether they interpret these costs as marketing or lobbying expenses, or as downright bribes. In essence, the game rhetoric represents political power as a mere extension to money – thus money is the ultimate source of power in the game world.

Money is also the determining factor for one of the few goal or *ludus* rules of the game: the player's money counter must not reach zero, or else the corporation bankrupts and the game is over. In fact, money is the only resource of which depletion ends the game. The lack of other constraints gives the player the opportunity to profoundly experiment with the irresponsible evilness of the tycoon role. As long as there is money left and the government is properly lubricated with it, the player can neglect all concerns on waste handling, safety and public discontent, ignoring the rising amounts of disasters, pollution and cases of cancer and death that will inevitably follow this kind of a playing style. The only risk is that the legal system may start to take interest in the player's actions, resulting in expensive lawsuits and compensation claims, but even they lose their significance as soon as the player can afford them – that is, when the production of the player's reactors is each year greater than the maximum cost of these disasters.

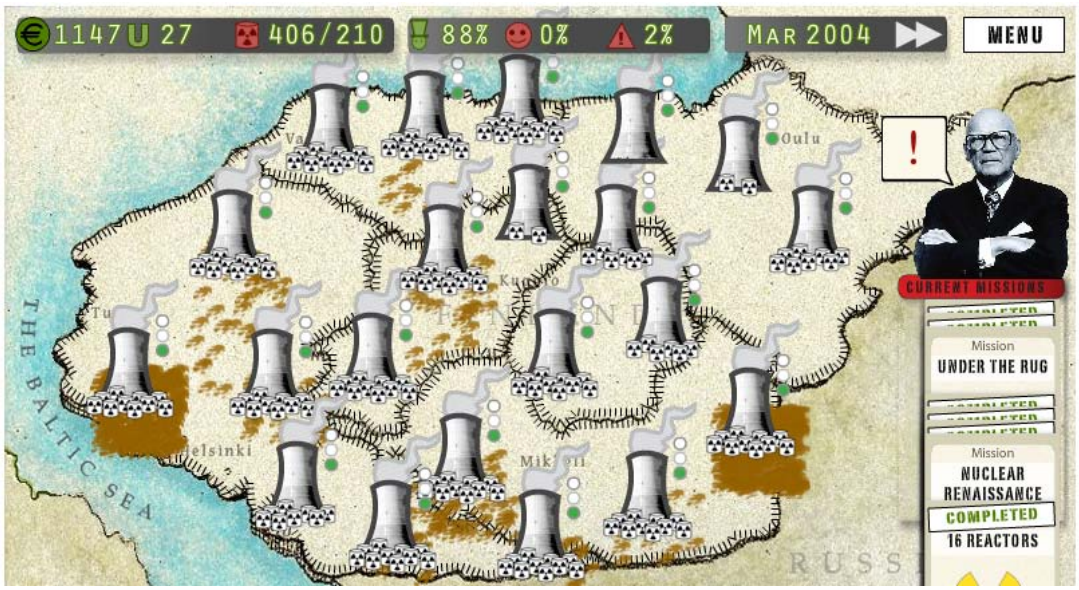

Figure 11. Even if the land is filled with waste and pollution, the game still continues as long as there is money left.

To sum up, the procedural rhetoric described above portrays the nuclear industry as a greed-fueled system, where the pursuit for monetary profit is prioritized above everything else. In terms of persuasion, one of the game's assets is its ability to show where this kind of ideology could lead in the worst-case scenario (Figure 11). Because of this, the goal rules of the game do not punish the player for playing the role of an evil tycoon. Instead, subtler instances of feedback rhetoric are used to hint at the possible negative consequences, such as the growing frequency of disasters, increasing amount of waste barrels and pollution stains on the map, and the raising figures of cancer and death in the progress report display.

4.4.2 "Playing safe is slow and expensive"

According to Greenpeace, nuclear power is an expensive way of producing electricity because of high costs in both construction and operation (Greenpeace International, 2007). To comply with this statement, the internal economy of *Nuclear Tycoon* is balanced so that playing safe is a slow

and expensive process. Players who prioritize maximum safety and proper waste handling find it very hard to make any decent profit.

There are many ways in which this balancing is implemented in the game rhetoric. Different reactor and contractor cards have different safety values, and because of the randomness of the card system, the safest options are not always available. The player may need to exchange the cards by using the "Skip to next year" button, in the hopes of getting the better options this way, but at the same time losing valuable game turns. Of course, the safest solutions are usually also the most expensive ones, so valuable money is lost as well.

Alternatively, the player may take a small risk and use the risky reactors or contractors, and hope that the rickety reactor can be quickly fixed after the construction. This is done by playing the repairs cards, which increase the safety percentage of a building by a small amount. But again, the player ends up losing time and money: the renovation consequently means that the reactor will be out of operation for at least one year – during which it will not produce any profit – and the repairs cards themselves are relatively expensive to play.

The intended side effect of these design choices is that they should tempt the player to give in and resort to the faster and cheaper – and correspondingly riskier or otherwise less ethical – solutions. This fortifies the previous statement about the undivided power of money by implying that in order to succeed in the nuclear industry, unethical choices are not only possible, but necessary.

4.4.3 "Nuclear power can never be completely safe"

Even if the player manages to play as safe as possible, the game is never risk-free in *Nuclear Tycoon*. One of the embedded statements is that nuc-

lear power can never be completely safe from accidents because no matter how strict the security policies are, there is always a possibility for unpredicted incidents in the form of natural or social disasters, human errors, or even plain neglect. Greenpeace mentions terrorism and proliferation as risks that should especially be concerned with (Greenpeace International, 2007).

In *Nuclear Tycoon*, safety is modeled as a resource, which represents the probability of any safety-related disaster in percentage points. Put more precisely, the risk of disasters is the difference between 100% and the player's safety percentage – for example, 90% safety means that there is a 10% chance for some disaster to occur. The game also notes the type of risk that the player takes: using unreliable contractors increases the risk of accidents, trading with manufacturers of nuclear weapons increases the risk of proliferation, and so on (see the safety section in the player's guide in appendix B for more details).

In addition, each of the player's buildings has its own safety percentage, affected by factors such as the qualities of the building plan and the contractor that were used to construct the building. As a result of this, an accident is the most likely to hit the building with the lowest safety score.

The insecurity of nuclear power is implied by the game rules in two ways. First, the maximum safety for reactors and other buildings is always 99%. No matter how many repairs cards are used, the safety will never reach full 100%. Second, there is always at least a 1% risk associated with each risk-inducing action card – even with the safest options – including all reactor plans and contractors as well as each trade card that involves the transport of radioactive materials. When the one risk percentage point of each of these isolated, seemingly low-risk activities is subtracted from the player's total safety percentage, the consequence is that their combined effect gradually starts to become significant as the game progresses. The message behind this procedural rhetoric is that if the international expansion of nuclear

construction continues as urged by the nuclear industry, so will also expand the problems associated with it.

The nuclear accident at Chernobyl in 1986 is frequently used in the rhetoric of Greenpeace's publications as a reminder of the insecurity of nuclear power (see e.g. Greenpeace International, 2007). To a similar rhetorical effect, *Nuclear Tycoon* also features this infamous incident as a world event card, along with many smaller accidents as disaster cards.

4.4.4 "The waste problem will escalate in the long run"

Of all the risks related to nuclear power, the problem of radioactive waste receives particular attention in the game design and especially in the current prototype. The prototype implementation of the waste problem is described in the player's guide in appendix B.

On the player's resource counters, waste is represented by two numerical figures: the total amount of waste in the player's possession, and the total amount of waste capacity; the capacity being the maximum amount of waste that can be currently stored in the player's buildings. In addition, much like in the case of the safety resource described in the previous subsection, each of the buildings has its individual waste amount and capacity values, displayed in the building tooltip.

Reactors are equipped with a small built-in waste storage facility, but once the reactor is in operation, its storage starts to fill up quickly with the waste that is the by-product of the reactor's production of money and electricity. After the storage is full, the reactor still continues to produce waste, and the storage begins to overload.

Each unit of waste that exceeds the player's total amount of waste capacity increases the risk of waste-related disasters by one percentage unit. The

disaster, such as an accidental leak of waste into the environment, is the most likely to happen in the reactor building where the waste storage is overloaded the most.

The player can postpone the problem by building separate waste storage buildings. Once ready, they collect some waste from the reactors at the end of each year. Their tradeoff is that they take away resources from the construction of the profit-making reactors, in the form of money, available contractors and land[12]. Also, even the larger storage buildings fill up eventually, leading to the same overloading problem that they were built to fix in the first place. Moreover, storage buildings face the same safety issues as reactors: they are more or less under the threat of accidents, as described above.

Another solution to the waste problem is to ship it abroad by playing the waste trade cards. However, that has its own downside as well, as the trade can increase the risk of transport accidents or proliferation. Later in the game the player is presented with the "New Nuclear Energy Law" world event that bans all export of nuclear waste, further limiting the player's options on the matter.

There is also a special rule associated with the "Russian businessman" waste trade card: by playing the card the player can export some waste to Russia for a small fee, but in the game system it also triggers the possibility for the "Waste leak from Russia" disaster to happen. This incident reveals how the exported waste was in fact dumped right next to the border of Finland, and how it is now contaminating the ground waters on the player's side. The rhetorical purpose of this causal connection is to illuminate how relocating the waste is not a solution to the problem but just a means of making it a local problem somewhere else.

[12] In the prototype, there is a limit of three buildings on each land area; thus the construction of storage buildings decreases the maximum amount of reactors that can be built.

In addition to the procedural means related above, *Nuclear Tycoon* also uses the level of representation and narrative to further illustrate the waste problem. The most prominent example of this is the accumulation of the barrel images on the map, gradually covering the whole lower part of a building graphic as the waste storage fills up (see Figure 11). Waste-based disasters can turn the barrels into brown stains of radioactive pollution, which cannot be removed but stay on the map all the way to the end of the game. The progress report display includes a 100000-year counter, which shows the number of years before the first radioactive waste produced by the player will start to become harmless to people and the environment. In general, these representations aim to draw attention to the escalating and everlasting natures of the nuclear waste problem.

An interesting emergent feature of the game simulation in the prototype is that at some point of the game, if the player gets enough reactors running and producing steady profit, all the risks concerning safety and public discontent can be minimized, because the player can afford to buy all the needed repairs and PR campaign cards. However, the waste problem still continues to escalate because the reactors are constantly producing more of it. Thus the game rhetoric portrays the waste issue as the only one that cannot even be solved with money.

5 Known Issues and Planned Development

As already mentioned in the introduction chapter, the development of *Nuclear Tycoon* is still in the prototype phase[13], and thus the game is still unfinished in many aspects. In this chapter, I present the known issues in the current prototype, as well as some proposed solutions for those issues. I also suggest some new features that could be added in future development. My focus here is on the plans that in my opinion are the most relevant in the context of this thesis, or that are otherwise essential in order to get the development finished. A more comprehensive description about the contents of the current prototype is available in the player's guide in appendix B.

Almost all of the functional features discussed in the previous chapters exist in the prototype, at least in a preliminary form. However, because of limited development resources, I was forced to leave some of them out, even though they are mentioned in the text. There are three such cases that I feel should be clarified here.

First, in section 1.2 I stated that Greenpeace had wished for a game design that would emphasize the inefficiency of nuclear power in terms of climate change prevention. This aspect is still present in the game concept, but it is not yet considered in the current prototype. The climate change dimension was left out because as a problem, it is dependent on the other addressed problems such as waste, safety and long construction times – in other words, these problems are some of the reasons why nuclear power is a bad solution to climate change. Thus I have needed to implement them first before a comprehensive handling of the climate change issue can be added. Also, I think that the current version already adequately demonstrates the

[13] At the moment of writing, Greenpeace has suspended the development of the game due to lack of resources. No decision on the actualization of the final production has been made yet.

arguments I have made in this thesis, and thus a more complicated version would not necessarily have been better in this context.

The other two features that are still missing are the in-game help screens and the level-based structure of the game, discussed in sections 3.5 and 4.2. They are mentioned in the text because they will be important aspects in the final game: the former justifies the game's persuasive arguments by providing access to factual information, whereas the latter reduces the complexity of the gameplay by dividing it into smaller, more comprehensible sections.

I will now present the other known issues and planned improvements and additions in three separate lists. The first list consists of improvements to the existing features of the prototype:

- *Locations*. Players can select the locations for their reactors, first by selecting the area where the land card is played, and then by playing the reactor plan card to a specific spot in that area. These choices however have no concrete meaning in the current game version – other than perhaps the fantasy of building the player's home town full of nuclear reactors – because all the locations are identical in terms of gameplay. In other words, their resource costs, building capacities and other attributes are the same. The first step in developing this situation would be to re-zone the map into such areas that would have different values for variables such as construction costs, uranium deposits, the people's attitudes towards nuclear power, and the risks of natural and social disasters.

- *More variation on cards*. The thematic content of the prototype is rather limited – there are only a few variations on each card type. Especially the disasters may start to repeat themselves if the player has accumulated only one or two of the different risk types. The solution is to simply add more cards to the game. Also the level structure,

when implemented, helps with this, as it is then possible to create different cards for each level.

- *Cards with four or more resource effects*. The present card layout dictates that a card can affect a maximum of three resources, one of which is always money. This limitation was initially designed to keep the cards as clear as possible, but for actions that have the most diverse effects, three resources may not be enough. For example, there is the "Sellafield" card in the prototype that is enabled after the world event that bans all waste trade. The card allows the player to circumvent the trade ban and transport some waste to the Sellafield reprocessing plant for a small fee, but the shiftiness of this action also angers the government – thus in terms of resource effects, the action drains waste, money and political power. It should also increase the risk of transport accidents, but that is left out because of the three-resource limit. As a result, the action hurts game balance by providing a too easy way for the player to get rid of waste. The solution would be to re-design the card layout to allow more resource effects, though the challenge is how to accomplish that without sacrificing the clarity.

- *Victory and loss conditions*. With the current one-level prototype, the game ends only if the player runs out of money. When the structure of multiple levels is implemented, it also enables new victory and loss conditions: the game is won by completing all missions and levels, and possibly lost if the player fails a certain amount of the missions.

The second list includes additional features that would enrich the gameplay and deepen the game's persuasive potential by adding new utilizable elements for the simulation rhetoric. On the other hand, these features can also make the game more complicated, which means that they should not be introduced to the player at once, but rather one by one, for example by introducing one new concept on each new level.

- *Competition*. Adding the renewable energy industry as a competitor of the nuclear industry would allow players to better evaluate their success in the game, as they would be able to compare their statistics with the ones of their competitors. It would also enable a more constructive rhetoric in the sense that the game would not only point at the problems of the nuclear power, but it would present a better alternative as well.

- *Elections*. To augment the significance of the public opinion resource, it would be possible to add an election event, which would periodically convert some or all of the public opinion percentage into the political power resource. This could have an unpredictable impact on the game balance though, so careful testing would be needed to find the right method for the implementation.

- *Reactor lifespan*. Each reactor in the game currently has a duration of sixty years, after which it simply stops operating. In reality the decommissioning of a nuclear power plant is a long and expensive process with its own safety issues regarding the clean-up of radioactive materials. The game's demonstration on the problems of nuclear power could be made more comprehensive by including these aspects in the simulation. Also the degradation of aging reactors could be simulated by lowering their safety percentage or raising their maintenance costs over time.

- *Transport routes*. Currently, the trading of radioactive materials can cause transport accidents, but the relationship between the transport destination and the site of the accident is random, and thus often inconsistent. If more explicit transport routes were implemented, the associated safety issues could be handled in a more conspicuous way:

the player could see on the map how the transport can endanger areas far away from the sites where the materials are produced.

- *Uranium mines*. As an additional building type, uranium mines would diversify the gameplay, especially in the areas of land acquisition and resource trading. They would also allow for a more tangible presentation of the associated environmental problems than the current uranium trade cards.

The last list of upcoming improvements concerns with the domains of game development that do not belong to the focus of this thesis. Their purpose here is to provide a more accurate view on the current state of the prototype.

- *Check the validity of the game content*. The current data that is used in the simulation algorithms and card descriptions is based on my own interpretations on the source materials, including discussions with Greenpeace personnel that are not documented in written form. The data is suitable for the demonstrative purposes of the prototype, but to ensure the credibility of the game, all content should be checked by Greenpeace or other experts before the game is published. It is true that some compromises between playability and accuracy may have to be made, but even then the expert help is needed to recognize these inaccuracies so that they can be documented within the game.

- *Improve the usability of the user interface*. There are many reported usability problems in the interface. For example, the zooming cards and the building tooltip pop-ups sometimes conceal other game objects, making it cumbersome for the player trying to click on those objects. An obvious lack is also the absence of loading screens, playing instructions and other such elements that are external to the game world.

- *Fix errors in the source code*. There are known errors or bugs in the game code, which can hinder gameplay. For example, the game over screen may sometimes stay open after a restart, making the game unplayable.

- *Add missing graphics and animations*. The visual design of the prototype is still in a preliminary state: its purpose is to give an overall impression of the game's look and feel, and to visualize the most important objects of the game system in a practical manner. The appearance of many of the objects is unfinished or altogether missing. For example, most of the cards have the radioactivity sign as their illustration because the card-specific graphics have not been created yet. In addition, the game could be visually enriched by adding animations to disasters, PR campaigns, operating reactors and other significant elements.

- *Add sounds and music*. The current prototype has no sound. Music and sound effects could be used to add another layer of depth to the game's message. As an example from another game, in *Oiligarchy* the natural soundscape of the environment is gradually replaced by the rhythmic clatter of the oil wells as the player builds them.

6 Design Evaluation

I have already begun to evaluate the design of *Nuclear Tycoon* in chapter 4 by analyzing the most important aspects of simulation and simulation rhetoric in the game. Is the simulation framed properly so that it concentrates on the persuasive elements? Is the simulation wide and deep enough, and not too much of either? And does the game comprehensively utilize the means offered by simulation rhetoric? These are some of the questions I have sought to answer by explaining the reasons behind the related design solutions.

In this chapter, I evaluate the game design solutions in the broader context of rhetoric and persuasion. I refer to parts of chapter 2 where the qualities of successful persuasion and rhetoric are defined, and deliberate whether these qualities exist in the design of *Nuclear Tycoon*.

In order to support my own evaluation, I conducted a small-scale qualitative test by inviting peers and personal friends to play the game prototype online and give some informal feedback. My main interest was to see if any of the respondents would spontaneously comment on the persuasive aspects of the game. For that reason, I kept the feedback questions in the invitation deliberately vague, only hinting at the possibility to comment on the game theme in a side note:

> "There are no formal requirements for your comments. You could tell e.g. how long did you play, what's your opinion on the game, and what kind of thoughts it made you have in relation to the theme of the game."

I sent the invitation to 117 recipients in Onni, the intranet of the School of Art and Design, and to 78 recipients in Facebook. I received 1 response from Onni, and 16 responses from Facebook. All of the respondents are adults and thus belong to the broadest definition of the target group. The comments were written in Finnish – I have translated excerpts of them to

English in the quotes below. Because of the small sample, no definitive conclusions can be drawn from the comments. I am interpreting them only as supplementary confirmation in parts where the comments support my own evaluation, or as hints of design problems that should receive more attention in future development.

The three virtues of rhetoric, described in section 2.3, can be used as a basis for evaluation: does the rhetoric of *Nuclear Tycoon* incorporate all these dimensions? The *docere* and *movere* dimensions have been important parts of the design and they are evaluated in the following sections on comprehension (6.1) and emotional engagement (6.2). The *delectare* dimension of rhetoric has been less considered in the current design. As a dimension that is mostly connected with the level of challenge in the game, it becomes more relevant once the level structure has been implemented. From there on, the individual levels can be designed so that the difficulty gradually increases as the game progresses.

In the sections to follow, I will also present two specific cases of concern that became apparent in the evaluation process: the replay value of the game (6.3), and the perceived qualities of the source of persuasion in the game (6.4). The final section presents some general findings on the persuasiveness of the current game prototype, as derived from the test results (6.5).

6.1 Comprehension

The *docere* dimension of rhetoric that appeals to the player's intellect has received particular attention in the game design. This aspect is also related to the quality of arguments in persuasive messages (see section 2.1). As mentioned in section 4.2, many different methods have been used in order to make the game information as comprehensible as possible. Also related to this dimension are the aspects of simulation described in sections 4.1 and 4.4. Many of these aspects rely on the player's ability to learn the rules by

which the nuclear industry operates in the game simulation. From there the player is expected to draw conclusions to the same rules in the real world and consider whether the game simulates the reality of the nuclear industry accurately or not.

Meaningful game rhetoric requires that each rule of the game is connected to the theme of the game (see section 2.3). I feel that this principle is well executed in the game design. This view is further justified by the player's guide in appendix B, where the thematic meaning of each game element is explained. Perhaps the least meaningful action in this sense is the "skip to next year" feature: it may seem unrealistic if the player has to lose almost an entire year because all the action cards happen to be disabled. However, even this feature has some relation to the theme, as noted in subsection 4.4.2.

What was unsettling in the test results is that over half of the respondents (10 of 17) reported at least some difficulties in comprehending the rules of the game. To 6 respondents the game seemed so overwhelming that they completely gave up trying to learn the game. None of them elaborated further on the reasons for the difficulties: "I don't understand anything", "I couldn't play" and "[The game] was confusing" were some of the typical comments.

However, three of the respondents that had difficulties in the beginning of the game managed to overcome them and did not report any further problems after that. This would suggest that the rules themselves are not flawed, but just that the learning curve of the game is currently too steep. Therefore it would seem that fixing the usability problems and implementing the level structure would be the first steps to make the game as accessible as it should be for casual players. Especially developing the guided tutorial phase of the first level would be crucial.

As for the other planned development, the addition of factual information in the form of in-game help screens would also be beneficial for the intellectual dimension of rhetoric because it would provide further evidence for the game's arguments.

6.2 Emotional Engagement

The *movere* dimension of rhetoric that aims for the emotional engagement of the players is discussed in the context of the game design in section 4.3. There the level- and mission-based structure of the game is presented as a system of goals that motivates the player by providing pleasure from both the achievements and the pursuits that are integral to the goals.

I would also see two other ways in which the game design consciously utilizes emotions for a persuasive effect. The first of them is the satirical humor (see section 3.5) that ridicules the seemingly pro-nuclear claims in the game content, working in favor of refuting those claims. This was also noticed by some of the testers, three of whom especially complimented the humorous side of the game:

> "I liked Kekkonen, Juha Mieto, Minister Leskinen etc. They were funny. All in all I liked the game's irony"
>
> "texts etc. were suitably funny"
>
> "Plusses for the good humor e.g. Toy reactors and other Oil crisis campaigns"

The second way is the system of risks and disasters, which represents the threats posed by the problems of nuclear power, and thus can be seen as an appeal to fear. The conditions for a successful fear appeal are listed in subsection 2.1.1. Of those, the seriousness of the threats is most obviously communicated in the game through the consequences of the disasters. The presence of the other conditions is however weaker. The selectable locations of the game map can partly help in bringing the threats closer to the players,

so that they feel that they are personally under those threats. This feature is however currently deficient, as notified in chapter 5. The fear appeal should also offer implementable solutions to the threats – a condition which is currently absent from the game.

To increase the persuasive effect of the fear appeal, the personal aspect of the threats should first be strengthened. The planned development of locations and transport routes in chapter 5 is one way to achieve this. The chapter also proposes the addition of competition in the form of renewable energy companies, which could help the players to see the solutions to the threats. In addition, the in-game help screens, when implemented, could include information on how the players can personally work in favor of the solutions – for example, by voting the right candidates in elections or directly contacting representatives in the parliament.

6.3 Replay Value

The replay value of a game can be an important factor in persuasion, especially in terms of fully understanding the rules of the game simulation (see section 2.5.). *Nuclear Tycoon* should be further improved in this aspect. For example, it was already mentioned in chapter 5 that there should be more different cards in the game, which would add variation and thus increase the replay value. The lack of content was remarked by 4 of the testers as well:

> "there should have been new things introduced in the game. After 10 minutes of playing, you got bored."
>
> "the player didn't have many different options for action"
>
> "The game gets a little tedious in the long run"
>
> "the relative scarcity of the cards' themes slightly began to decrease the interest towards the end."

Also the occurrence of the world events could be less predictable: instead of the current fixed events, each new game instance could have a random selection of randomly timed events.

6.4 Source of Persuasion

The source of the message is an important factor when determining the persuasiveness of the message. As presented in section 2.1, a message is more likely to persuade if it comes from a source that is perceived as expert and trustworthy by the audience. Moreover, if the source is perceived as biased, it is least likely to persuade. In the case of *Nuclear Tycoon*, Greenpeace is ultimately trying to change the attitudes of people who support nuclear power. This is a challenging combination because these people most probably perceive Greenpeace as a biased and untrustworthy source. The worst consequence could be that the game only manages to persuade players who already oppose nuclear power.

One solution would be to publish the game without any apparent associations with Greenpeace. An independent game developer would probably not be seen as an expert source, but the neutrality and the less obvious intent to persuade would work in favor of persuasion. Hiding the Greenpeace connection could however be regarded as a deceitful act and thus it cannot be recommended.

It would also be possible to count on the quality of the game's arguments alone, that is, to believe that the game has the ability to persuade regardless of the source. After all, if the central route of persuasion is achieved by means of the ELM approach (see subsection 2.1.2), the peripheral factors such as the qualities of the source have less impact. Some of the testers' comments suggest that if the alleged beneficial sides of nuclear power were somehow added to the simulation, the game's arguments might be more acceptable for pro-nuclear players.

Perhaps the simplest solution is however to rethink the target group and aim the game primarily at players who have not yet decided their stance towards the nuclear issue.

6.5 Test Results on Persuasion

None of the respondents explicitly mentioned that they had been persuaded by the game. On the other hand, all of the 11 testers that learned to play the game seemed to have understood the game's overall stance towards nuclear power correctly. Some comments also indicated a deeper understanding about at least some aspects of the game rhetoric:

> "The game dynamics seem to be such that the end result is inevitably a catastrophe"
>
> "I liked the game's irony and the clear stance against nuclear power. [...] It is also good that you have to consider the people and the politicians in the game"
>
> "each moment you really have to think what is needed to keep your own power plant rolling, so that you don't run out of money, the environment doesn't suffer and the politicians are content."

It is however unclear whether the writers of the above comments reflected these thoughts to the reality of the nuclear industry, or if they only considered them in the internal context of the game. An interesting exception was the three respondents that expressed the most positive attitudes towards nuclear power and also stated the most critical opinions on the game. Unlike others, they did explicitly associate the game rhetoric with the reality of the industry in their comments:

> "I would have hoped that the game was more realistic, now the game was focused only on accidents and polluting"
>
> "It would have been nice if the waste storage site could have been built right in the beginning, because that's how it's done in reality – or at least how it should be done."

> “The game is probably better suited for people with negative attitudes towards nuclear energy. I am not one of them though I do expect and demand particular safety and an ethical paradigm from this energy industry.”

Interpreting these comments, it would seem that the game did manage to turn these players’ attentions towards the problems of nuclear power, but it is uncertain whether any attitude change occurred.

7 Conclusions

The design goal of *Nuclear Tycoon* is to promote anti-nuclear attitudes by demonstrating the problems of nuclear power. Defining the game as a simulation has proved to be a feasible solution for the design of the game's persuasive elements, as it has allowed a versatile handling of the problems through simulation rhetoric. Especially the problems of safety and radioactive waste are prominent in the game design.

The game prototype was developed in order to experiment with the design solutions in practice. Although there are evident usability problems in the current version due to its unfinished nature, it seems to adequately demonstrate that the simulation represents the nuclear industry in the intended fashion. This view is supported by the test results: no misunderstanding about the game's message was detected, and at least some of the testers expressed deeper consideration on the simulated phenomena.

As for the ultimate goal of persuasion, this project did not give any definite answers to whether *Nuclear Tycoon* can change the players' attitudes or not. The observed understanding concerning the game's message shows promise in this aspect. On the other hand, the evaluation hints at a possible incompatibility between the game's primary target group and Greenpeace as the source of persuasion. To properly investigate the persuasiveness of the game, it should first be further developed in learnability and usability. After that, it should be tested with the target group, using surveys that specifically concentrate on the persuasive effects and measure the players' attitudes both before and after the game play.

Considering further development in general, the learnability of the game is the issue that should be improved most urgently, because the difficulties in the beginning of the game currently put off a major part of casual players. In a sense, the development has concentrated so much on the theme-related rhetoric that the basic task of game rhetoric – communicating the game

rules to the player in a comprehensible way – has been left unattended so far. Another important direction of development would be to improve the quantity and quality of the game's persuasive arguments, at least in the form of new cards and by providing access to factual information through the help screens. Together these would both increase the replay value and add to the credibility of the game's message.

For me, this work has been an immense learning experience in the practicalities of game design and development, including the technical side of Flash authoring and programming. Above all, this project has taught me much about persuasion and rhetoric in general, and of the multitude of meanings and uses that they offer to game design.

The work has also raised some interesting questions that I leave for others to answer. For example, I began to doubt whether player enjoyment is really relevant in the context of persuasion. It is presumable that if players enjoy the game, they play the game longer, which supports the retention step of the persuasion process. But can the enjoyment on the other hand lead to a flow-like state where the players are so concentrated on the internal meanings of the game rules that they no longer pay attention to the external, theme-related meanings of the rules? Other designers of persuasive games have voiced similar questions as well: do persuasive games have to produce fun or should they rather aim for other kinds of emotional responses (Ochalla, 2007)?

Another interesting question is about the one-sided nature of many persuasive games. It is of course natural that a game with a certain agenda downplays or omits the counter arguments that would oppose that agenda. Even in *Nuclear Tycoon* the message of the simulation rhetoric is rather one-sided – the opposing side is only present in the ironic narrative elements. The risk of the one-sided approach is that critical players see the message as biased and reject the game's arguments, in which case no persuasion is achieved. Perhaps in some cases, a more neutral approach would be

more effective – after all, if the persuader's view on the issue is indeed the truest one, it should even become apparent in a simulation that regards both sides of the issue.

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Miska Natunen 12.6.2009

Nuclear Tycoon

"Save the World with Nuclear Power"

Game Concept 1.4

Introduction

Nuclear Tycoon is a satirical game about building and managing nuclear power plants.

Player's Role

The player is a newly appointed leader of the nuclear power corporation alliance.

Player's Goal

The main goal is to reduce global CO_2 emissions as much as possible by building more nuclear reactors.

Background Story

The leaders of the world have finally realized that nuclear power is the only solution for the growing global need for clean energy. The largest nuclear energy corporations have formed an alliance to pursue their common goal: to save the climate from CO_2 emissions in 30 years. The leader of that alliance is you.

Genre

Construction and management simulation (CMS) with casual gameplay and an intuitive card game interface.

Technical Form

Single-player 2D browser game in Flash format

Design Goals

1) **Entertaining the player**
   a) by designing a simulated world where the pleasure of play comes from experimenting, discovery, planning and thought
   b) by using satire (in rules, content and style) in a way that is both funny and provocative.
2) **Promoting anti-nuclear attitudes**
   a) by demonstrating the inefficiency of nuclear power in terms of climate change prevention
   b) by demonstrating the problems and risks of nuclear power, with focus on costs, safety, proliferation and wastes.

3) **Activating players to influence decision-makers** to anti-nuclear decisions, by voting and direct communication.

Unique Selling Points

- No other CMS games about nuclear power exist at the moment.
- Education "disguised" as entertainment: A game that appeals to players even if they are not initially interested in the informative side of the game.
- The combination of satirical and procedural persuasion: the game representation praises nuclear power, but the game mechanics gradually prove that in reality, it doesn't work.

Game Atmosphere

The audiovisual style of the game is based on propaganda posters and films from the first half of the 20th century. This "parody of pro-nuclear propaganda" aims to present nuclear power as overly powerful, clean and perfect, drawing a sharp contrast to the severe problems that become evident during play. The point of this is to make the player doubt positive statements about nuclear power in general.

The same style is also applied to the scriptwriting to create a sarcastic, tongue-in-cheek atmosphere.

Gameplay

Overview

- Intuitive card game interface: first click on a card to select it, and then click on the game board to play it.
- Easy game controls: left mouse button clicks only
- Turn-based gameplay: one turn per month
- The three main elements of gameplay are:
  - Cards
  - Map
  - Resources
- The main game view also includes
  - Current missions
  - Advisor character

Cards

The cards represent the player's choices of actions to take, as well as disasters and other incidents that may happen during the game. The card types and their gameplay functions include:

- **Land**: Obtain developable land for your construction projects, or seize it from the competitors such as renewable energy companies
- **Buildings:** Construct and manage power plants, processing plants, mines and storage sites
- **Trade:** Buy and sell resources and waste
- **Associates:** Recruit politicians, officials, researchers etc. to get political power and protection from disasters
- **PR Campaigns:** Influence both politicians and consumers/voters by marketing, lobbying or downright bribes and threats

Gameplay in a Nutshell

1. **Build reactors** – the more the better!
2. **Make money** – if you run out of it, the game is over.
3. **Keep everybody happy** – you need both politicians and the public on your side!
4. **Hog the resources** – including uranium and developable land
5. **Avoid problems** such as accidents, pollution and angry citizens – and deal with them when they occur.

- **Disasters:** Solve problems caused by incidents such as natural disasters, armed conflicts and terrorist attacks, accidents, demonstrations and construction faults.

Map

- The 2D map works as the game board and illustrates ready and under-construction power plants, processing plants, mines, storage sites and transport routes.
- Different statistics can be shown as map overlays: uranium deposits, pollution and social stability.

Resources

The following resources are obtained and managed by the player:

- **Money**: available funds, income, expenses, shareholder profits etc.
- **Land**
- **Uranium** deposits and other fuel sources
- **Political power**
- **Public opinion**

There are also "negative resources", or hazards, that the player wants to avoid:

- **CO_2 emissions**
- **Risks** related to accidents, proliferation and natural disasters
- **Nuclear waste**
- **Pollution** (regular and accidental) and its impacts on humans and the environment

The current amounts of resources and hazards are displayed as on-screen resource counters or visualized on the map view.

Game Progress

- **Easy start**: The first level is a tutorial level with a small controllable area (i.e. one country) and only a few card and resource types.
- **Gradual complexity**: As the game progresses, new areas, cards and resources become gradually available.
- **Levels**: The game is divided into levels. Each level can have its own play area, timeframe, level goals (or missions) and theme. The theme can be used to emphasize one nuclear-related issue per level.
- **Missions**: The board of directors gives the player different short-term goals, which:
    - must be reached in order to get to the next level
    - award the player with bonuses (if accomplished)
    - Example: "Start 5 new construction projects in 1 year"
- **Advisors**: Each level has an advisor character who gives comments and advice in speech bubbles. Advisors can be used to focus the player's attention on the theme of the level.
- **Scoring**: The player's success is scored based on CO_2 reduction percentage, number of used game turns and amount of shareholder profits gained. Penalty points may be caused by pollution, casualties and public discontent.
- **Statistics screen**: The statistics help to track the player's progress by showing charts of the scoring variables, including comparisons to scores of competitors.
- **Winning**: The player wins when all levels and missions are completed.
- **Losing**: The player loses and the game ends if the player makes the corporation bankrupt. The game does not end because of meltdowns or other accidents.
- **Total duration**: The game can be finished in 1 hour.

Methods of Persuasion

Factual

All game content is based on **researched information**, and the sources are mentioned in the game so that the player has the possibility to review them. This contributes to the credibility of the game's stance towards nuclear energy. Also, the game map is based on **actual current locations of nuclear power plants**, uranium mines etc. This helps the player in realizing how the problems are situated in reality, from both local and global viewpoints.

Procedural

Fighting climate change with nuclear power requires extensive increase in nuclear construction, which in turn greatly increases the safety risks and other related problems. These **causes and effects** are emphasized in the game mechanics in a way that helps the player to comprehend the **magnitude and complexity of these problems**, and also to realize **how they're interrelated**.

Satirical

Although, according to research, satirical approach tends to carry little direct persuasive effect, it can aid persuasion in many ways. Satirical style allows the use of **caricatures of real political figures**, familiarizing the player with the real-life faces influential in nuclear matters. Satirical humor can make the game more **appealing to a broader target group**. Even if the satire is misunderstood by some, it can work in favor of persuasion as long as it **provokes discussion** around the game.

Advertising

Throughout the game, **player's result is compared to emission reductions achieved by other means during the same amount of time**, including increased use of renewable energy sources and electricity-efficiency measures. This works as a kind of an **advertisement for the better climate solutions**, as they will either show better results than the nuclear path, or show how the loss of subsidies to nuclear power has hurt their development. The game also provides **links to sites with more information** and discussion.

Target Group

Primary: The main target group is **males in the age range of 15-34 years**, as they

- are the most active group in gaming and trying out new games
- currently have the most positive attitudes towards nuclear power.

Secondary: The game appeals to **broader groups of casual gamers** by the means of

- the genre of CMS, which appeals to all sexes and age groups because it doesn't include explicit violence or fast reflex based action
- using familiar, interesting characters as advisors and associates, which may attract players who wouldn't otherwise be interested in the more abstract map representation
- publishing the game on casual game websites (in addition to publishing/linking it on Greenpeace websites)

Localization and Customization

The game is designed to support localization of:

- language
- game map
- advisor characters

The game engine can be used as a base for developing other games with similar gameplay and different themes in the future.

As an on-line game, its content can be updated on the fly. Due to this, it's possible to reflect actual world events in the game by adding related content (in the form of new cards, for example).

Workgroup

The design and demo production of the game is a part of the master's thesis work of Media Lab student Miska Natunen.

Currently confirmed workgroup members and associates are:

- Lead designer: **Miska Natunen** (game, audio and software design)
- Lead artist: **Ramyah Gowrishankar** (graphics, animations)
- Client: Greenpeace Finland / International
    - Content consultants: **Lauri Myllyvirta**, Energy campaigner and **Topias Salonen**, Assistant energy campaigner
    - Coordinator: **Virpi Oinonen**, Online producer
- Media Lab, University of Art and Design Helsinki
    - Contact: **Pipsa Asiala**
    - Advisors: **Miikka Junnila** and **Petri Lankoski**

Miska Natunen 12.9.2010

Nuclear Tycoon

"Save the World with Nuclear Power"

Player's Guide (PROTOTYPE VERSION)

Foreword

This is a draft version of the player's guide for Nuclear Tycoon, edited to comply with the master's thesis version of the game prototype.

The prototype is created in Adobe Flash using ActionScript 2.0 as the programming language. It can be run in any web browser with the Flash plug-in installed. In terms of content, it is essentially a playable demo of the game's first tutorial level – no other levels are implemented yet.

After the tutorial phase, the same level continues with a couple of extra missions that deal with waste problems and the consequences of the Chernobyl disaster. They're included in the prototype in order to introduce some aspects of the simulation that wouldn't become apparent during the tutorial missions alone. Especially the addition of the "Under The Rug" mission that deals with the inflation of waste storages was important, because it demonstrates how one single problem can be handled in more detail by the game engine. In the final game these more complex missions and features will not be introduced until later levels.

In addition to the lack of the level structure, there are also other features that are mentioned in this guide but are not yet implemented in the prototype. They are indicated with a gray background in the text.

Storyline

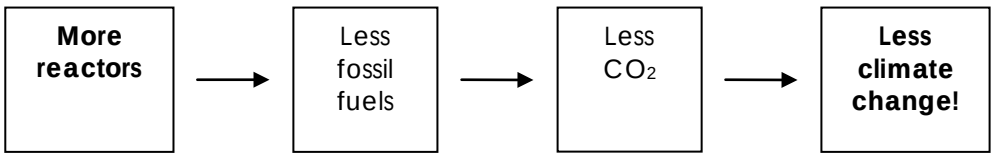
You, as the player, take on the role of a newly appointed leader of the nuclear power corporation alliance. Your task is simple:

Stop the climate change with nuclear power!

And the best way to do that:

Build as many nuclear reactors as possible!

This is based on the following chain of logic:



In addition to your main activity of building reactors, you'll also need to take care of many supporting activities, of which the most important are:

- **Make money** – if you run out of it, the game is over.
- **Encourage positive attitudes towards nuclear power** by keeping both politicians and the public happy.
- **Ensure the availability of other essential resources**, such as uranium and developable land.
- **Avoid problems** such as accidents, pollution and angry citizens – and deal with them when they occur.

Game Flow

The gameplay is turn-based. One turn corresponds to one month of in-game time.

The cards in your hand represent the action proposals you have received from your board of directors. You can play one action card per turn on the table. Each played card is replaced by a new card from the board of directors.

After each year, all the action cards in the hand are exchanged for new ones, as the board of directors prepares for the challenges of the beginning year.

The game is divided into levels, starting with an easy tutorial level, where the advisor character explains the basic rules of the game. The tutorial begins in the year 1969, where your task is to build the first nuclear reactor in Finland.

After the tutorial, the game gets gradually more challenging by each level. Each level has a timeframe of two or more years (that is, at least 24 turns per level). The main timeframe of the game is 30 years, from 1990 to 2020, but individual levels may also be timed before or after that.

Each level consists of a set of missions, which you have to complete in order to reach the next level. The board of directors delivers these as mission cards. The goal of a mission can be e.g. constructing a certain amount of reactors, or gaining a certain amount of political power or other resource. If you fail to complete the missions, you get the option to retry from the beginning of the level, or to retire, which ends the game. The level also fails if you run out of money.

In addition to action and mission cards, you may also occasionally receive reports of important incidents as disaster and world event cards. They may sometimes have a radical impact on your gameplay.

You win the game if you successfully manage to complete all the levels. After the last level:

- The final score is calculated and shown.
- Your advisor gives you a verbal rating based on your score and actions during the game.
- The score is stored on a hi-score list on the server.
- You get a peek to the future and see how your actions continue to affect the world after 100, 1000 and 10000 years.

How to Play

Main Game Interface

The user interface resembles a mix of a traditional board game and a solitaire card game. The main gameplay is extremely easy:

1. click on a card you want to play
2. click on a target on the table where you want to put the card.

All other steps are performed automatically by the game system.

The following picture illustrates the main elements of the interface, with explanations of the numbered elements below.

Image 1. The main game interface.

1. **Advisor**
   - The advisor gives you useful tips and comments on your progress in speech bubbles (click on the advisor portrait to read them). He also forwards the action cards from the board of directors to you.
2. **Actions (Your Hand)**
   - Each turn you select one proposal to be taken into action → you play one action card on the table.
   - The selected card is placed either on the map or the hand of the industry, depending on the type of the card.
3. **Resources (Counters)**
   - Each action costs or earns you some resource points. The amounts and types of resources affected are printed on the action card. When a card is played, the resource counters decrease or increase accordingly. The color of a resource icon indicates the current state of that resource: green is good, red is bad and yellow is in between.
4. **Map (Game Board on Table)**
   - When the card is on the map, it may produce and/or drain one or more resources by a small amount each year. These amounts and types of resources are printed on the card. Their effect on your total resources is calculated after the end of each year.
5. **Missions**
   - Mission cards are automatically added here as soon as they're drawn from the board of directors. Completed missions may grant you bonus resources or other rewards.
6. **Next Year Button**
   - Advances game time till January of next year.
7. **Menu Button**
   - Opens the main menu, where you can restart the game.

The hand of the industry appears when you select a card that can be played on it. The hand represents your subordinates who carry out your orders concerning trade deals, PR campaigns, recruiting and other such actions.

You can get more information on cards, resource counters and other interface elements by rolling the mouse cursor over them. With cards, this opens a description bubble, which may also include a link labeled "Is this for real?!". This link in turn opens a separate help screen, where the function as well as the factuality of the card is thoroughly explained.

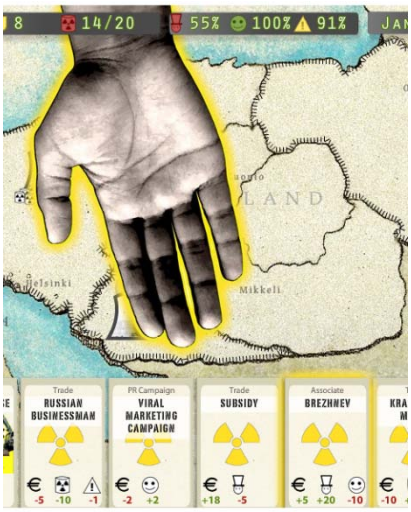


Image 2. The hand of the industry.

Map and Buildings

To build power reactors or other structures on the map, you need to play three suitable cards in this order:

1. **Land card**: Claim a location that is suitable for the type of building you want to construct.
2. **Building Plan card**: Select the blueprints for the reactor or other building that you want to build, and place it on the map at the desired location.
3. **Contractor card**: Select the contractor firm that will perform the actual construction job, and place it on top of the building plan on the map.

Different contractors have different estimates on how many turns the construction will take to finish. The construction progress is displayed on the map as a percentage of completed work. Be aware that surprises such as construction faults, accidents or demonstrations may cause delays in the schedule. Also, there's only a certain amount of contractor cards in the play, so if all of them are busy, you'll have to wait for one of them to finish before you can start another construction project.

When the construction is finished, the building is ready for resource production.

After you've claimed a land area once, you can construct several buildings there just by playing a new building and contractor card on the same location. You can build a maximum of three buildings per location.

Building Operation
A building is up and running when the "traffic light" next to it is green. If the light turns red, it means that the building has stopped operating either because of a lack of resources, or because it has been broken for some reason. Stopped buildings don't produce any resources but they still cost money in maintenance, so it is best to solve these situations as quickly as possible. See the chapters on *Repairing* and *Uranium* for more information.

Repairing
A broken building cannot operate until it's repaired. This is done by playing a repairs card on the building. This starts a renovation, which typically lasts for one or two years.

An operating building can also be repaired, if you want to improve its safety. Repairing always increases the safety of a building by one percentage point, up to the maximum of 99%.

Trading, Recruiting and Campaigning

You can trade your resources, recruit associates and launch PR campaigns by playing trade, associate and PR campaign cards, respectively. All of these cards are played on the hand of the industry, and their effect on your resources is immediate.

Resources

 *Money*

Money is the most important resource. Most of the actions require some money. If you run out of money, the corporation bankrupts and the game is over.

How to get more money:

- Build more reactors: they produce energy, which is sold for revenue.
- Build more uranium mines: surplus uranium can be sold if you find a buyer.
- Establish trade contracts: sell your surplus uranium or other resources abroad.
- Use your political power to seize subsidies from the government.
- Use PR to lure investors.
- Some countries may pay you if you pledge to take care of their nuclear waste.

 *Uranium*

Uranium keeps your power plants running and producing energy and money. To get uranium, build your own uranium mines or buy some from abroad.

If you run out of uranium, your reactors stop operating. They will restart as soon as you replenish your supplies. Do it fast because stopped reactors waste money instead of producing it.

 *Nuclear Waste*

In addition to pure energy, your power plants also produce nuclear waste. The plants have a limited capacity of waste storage. If the amount of waste exceeds these limits, a spill may happen, causing accidents and radioactive pollution, and increasing your public discontent points.

You can increase your storage capacity by building storage facilities. Once a storage is ready, some waste is moved from your reactors to the storage at the end of each year until the storage is full.

On occasion, you may get a chance to get rid of some of your waste by shipping it abroad. This may cost you some money, though. On a rare occasion, you may actually get some money for your waste by selling it for fuel reproduction.

 *Political Power*

Political power shows what percentage of the government supports nuclear power. Political power is needed to get all the necessary licenses for building and operating nuclear power plants. It needs to be over 50% in order to get any favorable decisions through the government.

You gain political power by recruiting politicians, scientists and other influential persons as your associates. Many of them like to get some cash for their efforts, but there may also be other ways to convert them to your side.

 ***Public Opinion***

Similarly to political power, public opinion shows what percentage of the general public supports nuclear power. You annoy the public by:

- causing accidents and other disasters
- causing radioactive pollution
- bribing politicians
- trading with unpopular parties
- excessive use of force in dismantling demonstrations

You can improve opinions by launching clever PR campaigns, reducing CO_2 emissions and hiring popular celebrities as your associates. Public opinion also slowly improves over time, if you manage to stay away from trouble for a while.

Great discontent can cause outbreaks of demonstrations, expensive lawsuits and other related disasters.

 ***Safety***

Many actions are more or less risky, thus decreasing your safety percentage. These include:

- Building reactors in areas that are geologically or socially unstable
  → When a natural or societal disaster occurs, it's more probable that you reactors are affected.
- Using the more unreliable (but temptingly cheaper) reactor models or workforce
  → Increases the chance of faults and accidents both in construction and operation of reactors.
- Neglecting the repair needs of existing power plants
  → Increases the chance of accidents in reactors.
- Trading resources with parties that are capable of nuclear weapons manufacturing
  → Increases the chance of incidents related to proliferation.
- Transporting waste or other radioactive materials abroad
  → Increases the chance of transport accidents.

Each risky action increases one risk point type: natural disasters, accidents in buildings, accidents in transport, or proliferation. The on-screen safety counter represents the total safety after the sum of all different types of risk points has been subtracted. The lower the safety, the more probable it is that a disaster will occur. The type of the disaster is determined by the distribution of your risk point types: if you've mostly got accident points, it's more likely that an accident will happen.

Disasters

Disasters can be caused by high amount of waste, bad public opinion and low safety. When a disaster happens, a disaster card is drawn and shown in a display with a description of the incident and its consequences. The cause of the disaster is indicated as resource icons in the corners of the display.

Image 3. Disaster display.

The possible consequences of disasters include:

- Negative effects on resources
- Radioactive pollution, which in turn may harm people and the environment. Pollution appears as brown stains on the map.
- Injuries and disease
- Deaths
- Delays in the construction of a building
- Building stops operating for a certain duration
- Building stops operating until it's repaired or the problem is solved
- Building is destroyed beyond repair

Possible resolutions after a disaster:

- Wait until the situation has passed
- Try to cover up the disaster or downplay its consequences by using PR or bribes
- Use a repairs card to repair the building
- Use a security service to dismantle a demonstration
- Use an influential associate to solve the situation
- In order to decrease the likelihood of the same disaster happening again, try to fix the cause of the disaster by e.g. building more waste storage, launching positive PR campaigns or improving the safety of your buildings.

Competitors

If you're not aggressive enough in spreading the nuclear message all over the world, at some point of the game your competitors may start to take over. You'll then see how wind power generators and other renewable energy based power plants begin popping up on previously unclaimed locations.

You cannot construct your own buildings on a location that is occupied by your competitor. However, you can play a company takeover card on the location, which buys the competitor off

the market, closes down their power plants, and frees the location to be claimed for nuclear construction.

Progress Tracking and Scoring

In the main game view, you can see the progress of your current missions, as well as the total amount of completed missions.

After every five years, a progress report is displayed, containing:

- Amount of built reactors
- Amount of CO_2 saved
- Amount of profits (current money - start money)
- Amount of subsidies received
- Amount of radioactive waste produced
- Amount of years for the waste to start becoming harmless
- Amount of caused radioactive pollution
- Amount of disease and deaths caused by the pollution

The report also shows the progress of your competitors (fossil fuels and renewable energy) for comparison.

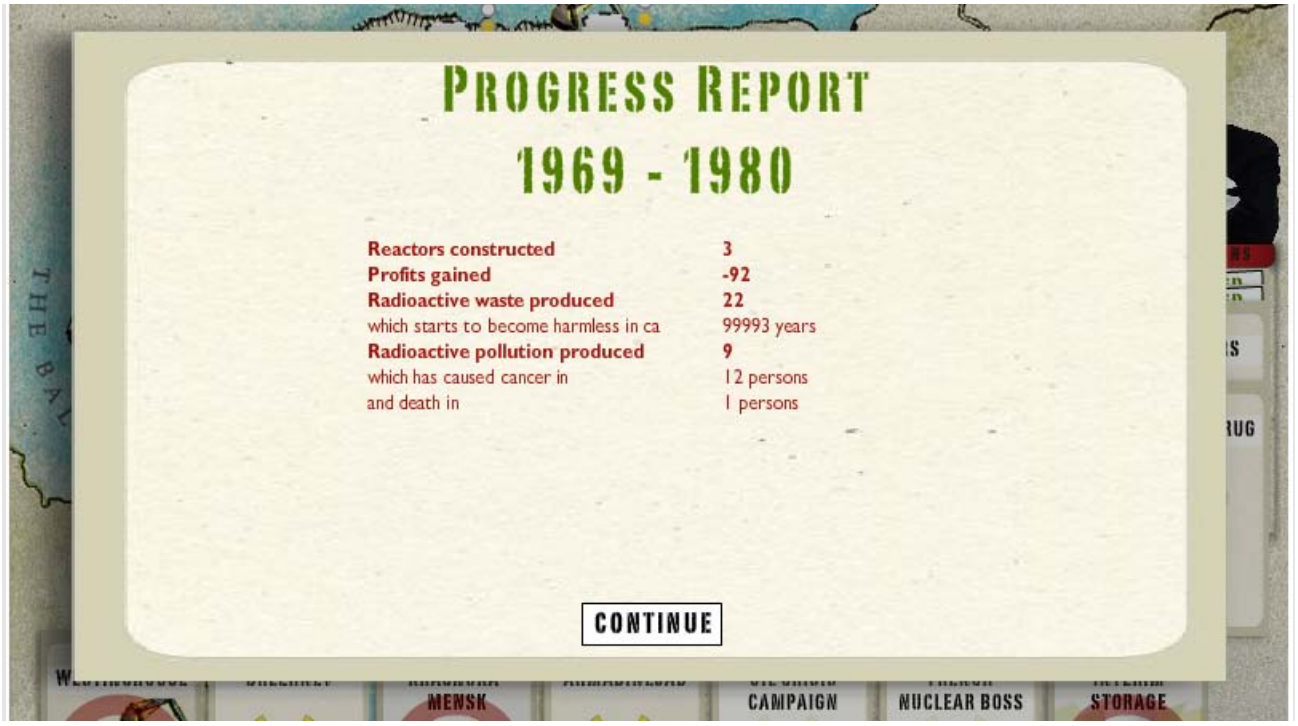


Image 4. Progress Report.

Scoring is based on

- Amount of operating reactors (and hence the CO_2 savings granted by them)
- Amount of completed levels and missions
- Amount of years survived (if the game ends before the time limit of the current level)
- Bonus points from money and positive public opinion
- Minus points from waste, pollution and public discontent

Card Reference

The following subchapters list all the card types in the game, with example cards on the side.

Cards Played on Map

- **Land cards**:
  Play on the map to claim land for you construction projects.
  - Land Purchase: Buy an unoccupied land area.
  - Company Takeover: Seize the land from a renewable energy company.

- **Building plan cards**:
  Play on your land to reserve a spot for construction.
  - Reactor: Produces energy and money.
  - Storage: Stores your nuclear waste.
  - Mine: Build mines on uranium-rich lands to produce fuel for your reactors.
  - Reprocessing plant: Converts waste to reusable fuel.

- **Contractor cards**:
  Play on a building plan on the map to start construction.

- **Repairs cards**:
  Play on a building on the map to repair.

Cards Played on the Hand of the Industry

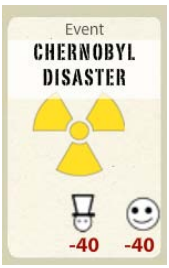
- **Trade cards**:
  Trade you uranium, waste or other resources.
  - Subsidy: A special kind of trade card that trades your political power for money.

– **Associate cards**:
Politicians, scientists and other influential people who can aid in raising you political power, public opinion or other resources – often with a cost, though.

– **PR campaign cards**:
Tools for improving the public opinion towards nuclear power.

Cards Played Automatically

– **World event cards**:
Events of the world that happen without your influence but have consequences that affect your play.



– **Disaster cards**:
Disastrous events that can be either provoked or prevented by your actions. See the chapters *Nuclear* Waste, *Public* Opinion, Safety and *Disasters* for information on the different types of disasters.

– **Mission cards**:
Give you tasks that need to be completed in order to win the game.